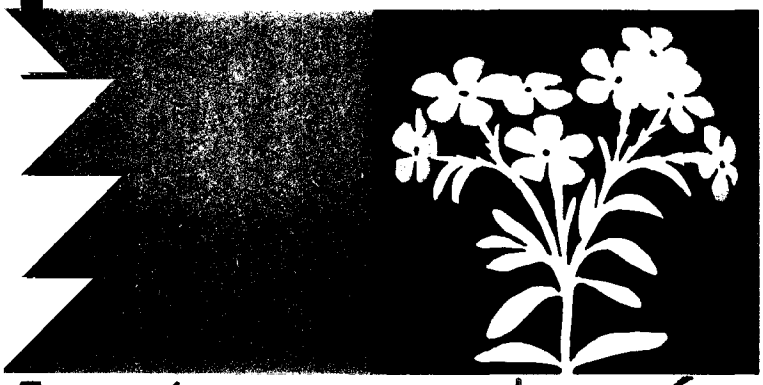
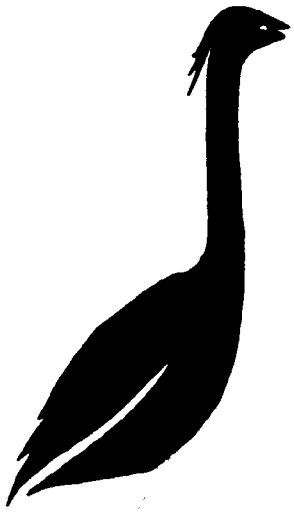
Presque Isle State Park

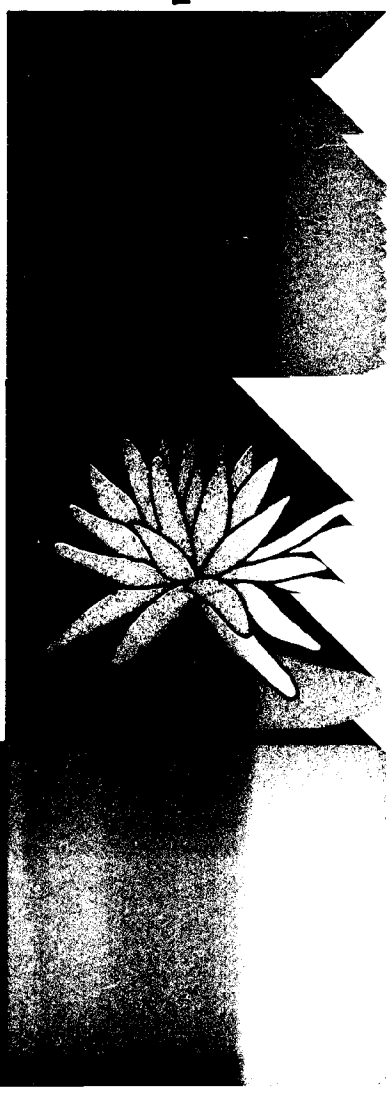
Environmentally Sensitive Area Study

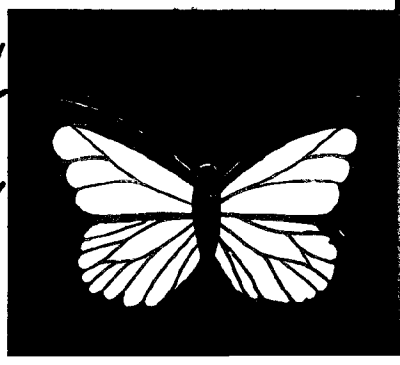
Prepared for the
Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of State Parks

The RBA Group ENGINEERS • ARCHITECTS • PLANNERS









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PENNSYLVANIA COASTAL ZONE MANAGEMENT PROGRAM

PRESQUE ISLE STATE PARK
ENVIRONMENTALLY SENSITIVE AREA STUDY

PRESQUE ISLE STATE PARK,
ERIE COUNTY, PENNSYLVANIA

Prepared by:
THE RBA GROUP
for
Department of Environmental Resources
Bureau of State Parks

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PRESQUE ISLE STATE PARK
ENVIRONMENTALLY SENSITIVE AREA STUDY
ERIE COUNTY, PENNSYLVANIA

FINAL REPORT
JUNE 30, 1989

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PRESQUE ISLE STATE PARK: ENVIRONMENTALLY SENSITIVE AREA STUDY

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PREFACE

Environmentally sensitive areas within Presque Isle State Park are put forth in this study as areas requiring special management consideration. ESAs within the park are the most significant and sensitive natural areas and require special consideration in the determination of management actions because of the sensitive features that they contain.

The methodology applied in this study encourages a dynamic process for the identification of ESAs. This process of identification uses existing available data in a series of well defined and replicable steps. Since the sand spit forming Presque Isle is extremely dynamic and subject to changes imposed by strong natural forces, such as winds and waves, over relatively short time spans, the identification of ESAs must respond accordingly. Therefore, as data for Presque Isle is updated or as new information is collected, the identification of ESAs should be modified or revised. As such, this study provides an interim step in the development of an overall resource management plan for the park and a tool for further study and refinement of environmentally sensitive areas within the park. By preparing this study through the use of a Geographic Information System (GIS) park management has been provided with not just the results of the study but the means to refine and update the study as well.

Another very dynamic aspect associated with the identification of ESAs in this study is the classification and location of species of special concern. As new species are discovered, as additional sightings are documented, and as the status of species changes over time it is important to view the area or sites affected by these changes. ESA boundaries should adjust accordingly. These future revisions and additional information can be incorporated into the

identification of ESAs through the GIS system and the methodology prescribed by the study.

The need for a more accurate and up-to-date base map of the park was identified early in the study and was determined to be beyond the initial scope of the study. However, while working with the available data it becomes apparent for instance that data derived from 1986 aerial photographic coverage does not exactly match the original base mapping. This is especially true with regard to the dunes and draft beaches at the distal end of the sand spit and in the area of Thompson Bay as illustrated by Figure 13 herein and by the map in Appendix G. A new base map from high level aerial photographic coverage is planned for the near future. Through appropriate map-to-ground referencing, data collected for the GIS data base can be made compatable with the new base mapping.

Finally, it is hoped that the GIS system developed during the course of this study may also be used as a tool to facilitate communication among researchers in the park, park staff, and others interested in protecting and managing the park's resources for the benefit of plant and animal species of special concern and for the provision of high quality recreational opportunities for park visitors.

OVERVIEW AND EXECUTIVE SUMMARY

Locally known as "the peninsula," Presque Isle State Park is a recurved sand spit stretching approximately seven miles in a northeasterly direction along the Lake Erie shore of the City of Erie. In an area roughly 3,000 acres in size diverse ecosystems varying in age from one to several hundred years are exhibited. At Presque Isle, a rare opportunity is provided for plant and animal succession on sandplains, dunes, marsh, and in lagoons and ponds.

Use of Presque Isle as a living laboratory by local universities and independent researchers often competes with recreational activities. The park serves over five million visitors annually.

Presque Isle's combination of ecologically important areas and recreational values requires careful management of the park for both ecological and recreational values in order to maintain species diversity and continue to provide quality recreational opportunities.

The RBA Group has prepared an Environmentally Sensitive Area Study to identify the most Environmentally Sensitive Areas (ESAs) within the park requiring special management consideration. The project approach employed for this study recognized a need to manipulate a large array of existing data at various scales and detail in order to identify the most significant and sensitive natural sites within the park. The methodology focused on an explicit and replicable process for this identification. A Geographic Information System (GIS) provided the means and flexibility to manipulate the data in a manner which, if done in a traditional hand overlay method, would have been overly cumbersome and limited.

The methodology for the ESA study was effected in four steps: data collection, data analysis, analysis modeling, and data synthesis. The data collection effort first classified the data gathered using a standard nomenclature. Data useful for modeling purposes was then encoded into a uniform grid cell data base addressable by the GIS command language. Data analysis, step 2, was conducted concurrent with the data collection effort and provided the data sift. Existing available information regarding the park's resources was obtained from the park's archives and workshops held with park researchers and staff. Step 3 involved the creation of analysis models using the GIS command language. Individual models were developed for each predefined ESA criteria. A composite model identified the most significant areas within the park, or the ESA "hot spots." Step 4 transferred locations highlighted by the composite model to the topographic base map of the park by correlating the ESA "hot spots" to identifiable ground features, natural community boundaries, and cultural or biological edges. Nineteen discrete ESAs were delineated.

A description of each ESA provides a general description of its features, its size, an indication of criteria fulfilled and a listing of species of special concern sighted within its boundaries. In addition, the sensitivity of each ESA is addressed by a listing of specific management considerations.

Finally, ESAs are ranked into five levels of importance by correlating their "significant value."

INTRODUCTION

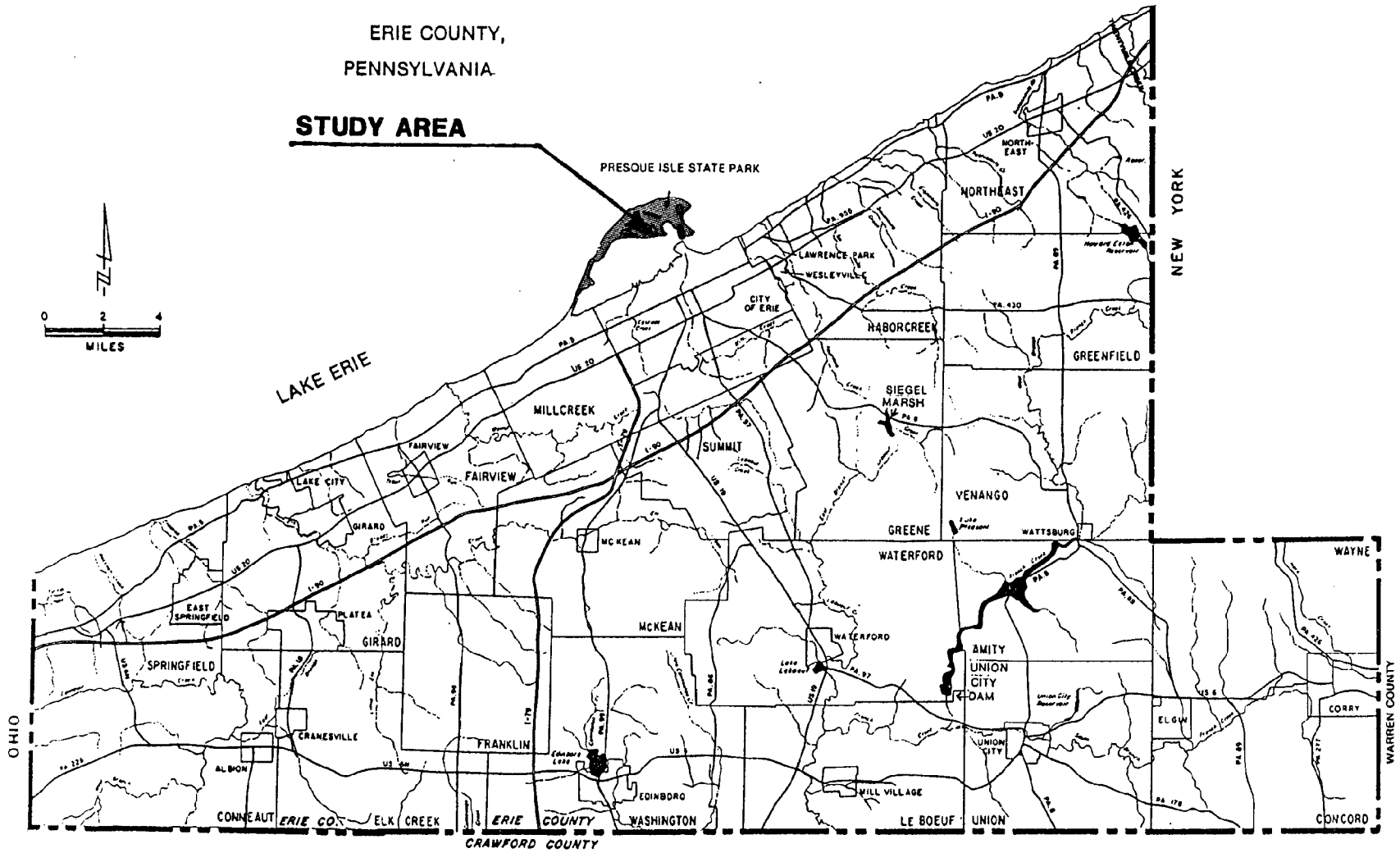
Background and Setting[1]

Presque Isle peninsula is a recurved sand spit stretching approximately 7 miles in a northeasterly direction from the city of Erie, on the Pennsylvania shore, into the waters of Lake Erie (Figure 1 - Study Location). Uncommon along the south shore of Lake Erie and on the North American continent, the peninsula was created after the last glacial period (11,000 years ago) and after Lake Erie generally reached its current elevation above sea level (8,000 years ago). The sandy deposits composing the spit derive from stream and lake cliff erosion, and transport from the west.

Wave action and currents cause erosion on the Lake Erie side of the peninsula and deposition at its northeastern tip. This process of erosion and deposition results in a gradual movement of the spit in an easterly direction along the shoreline. Before the construction of shore protection devices the narrow "neck" of the peninsula was breeched occasionally during severe storms.

Presque Isle's dune and marsh ecosystem is unparalleled in Pennsylvania and unusual in the United States. The peninsula is registered as a National Natural Landmark and harbors a number of plant and animal Species of Special Concern at the State and National levels. At Presque Isle, the ongoing process of plant and animal succession on sandplains, dunes and in ponds, which is driven by the combined action of winds, currents and waves upon the sand spit, provides the opportunity to study diverse ecosystems varying in age from one to several hundred years (see: Figure 2 - Major Botanical and Geological Stages).

Presque Isle State Park, which encompasses the peninsula, was created by the Pennsylvania legislature in 1921, and now serves five million visitors annually.



(MAP SOURCE -JEAN STULL)
USED WITH PERMISSION

FIGURE 1 - STUDY LOCATION

Many of these visitors use its nearly seven miles of sandy beaches on Lake Erie. Park boundaries extend 500' offshore and include parts of Lake Erie, and Presque Isle Bay.

In Presque Isle's nearly 3000 acres there is a complex array of freshwater ecosystems supporting a variety of uses. The peninsula's combination of ecologically important areas and recreational opportunities requires careful management of the Park for both ecological and recreational values in order to maintain species diversity and continue to provide quality recreational opportunities.

Scope of Work

The Commonwealth of Pennsylvania Department of Environmental Resources (DER) along with a local citizen group began development of a Resource Management Plan for Presque Isle in 1986. The Presque Isle Advisory Committee was formed as the plan evolved, and reviewed and commented on Phase II plans. In conjunction with this effort, The RBA Group Inc., and James Dobbin Associates have been retained by the Commonwealth to conduct a study to identify and rank Environmentally Sensitive Areas (ESA) at Presque Isle. An ESA is defined for this study as:

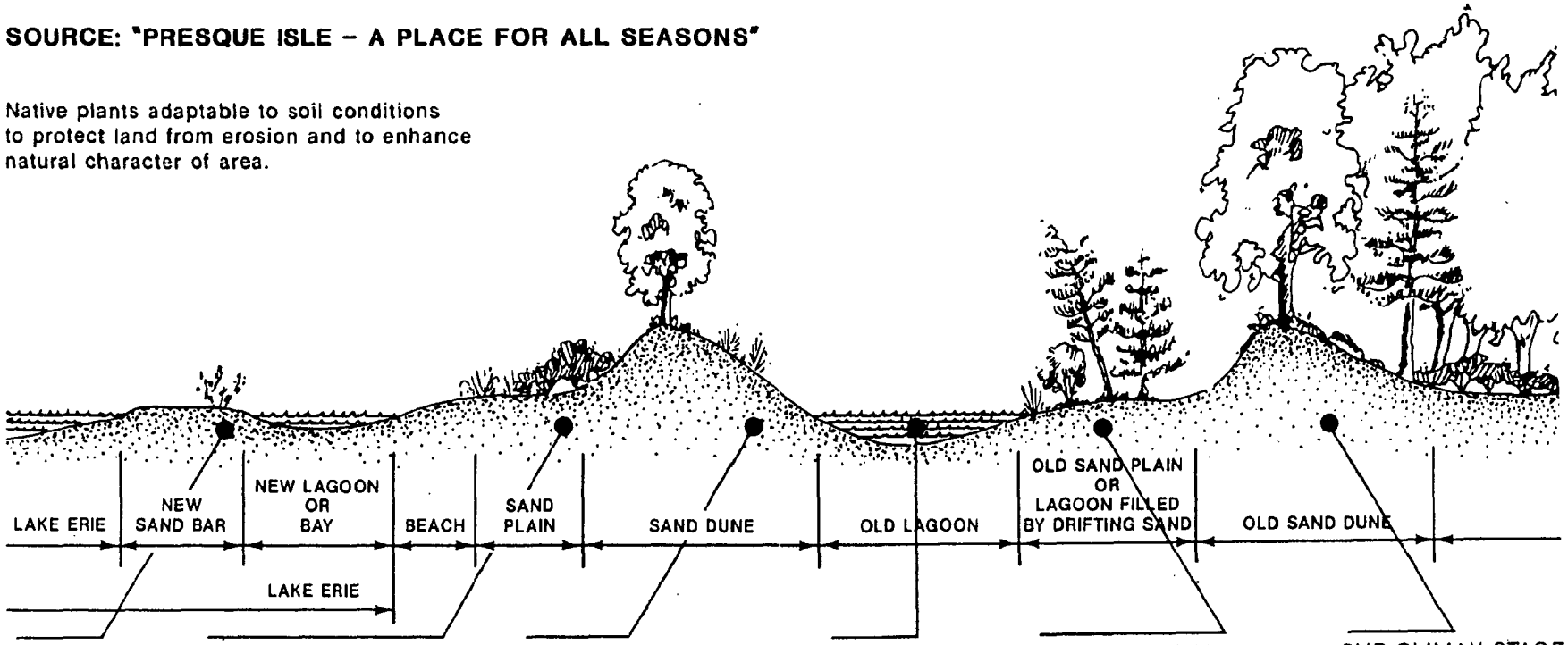
> an area which contains an ecosystem whose biological and physical integrity, as well as its ecological processes, should be maintained and protected. Within a park, they are the most significant and sensitive natural sites. They require special consideration in the determination of management actions because of the sensitive features that they contain.[2]

Specifically, the study team has been asked to identify the Environmentally Sensitive Areas of Presque Isle State Park, using pre-established criteria as outlined in a Study Design prepared by Paul Eagles; map each of the environmen-

tally sensitive areas; rank each of these areas; and prepare a final report that provides a written description, map, and account of the reasons for the determination of each site as an ESA.

SOURCE: "PRESQUE ISLE – A PLACE FOR ALL SEASONS"

Native plants adaptable to soil conditions to protect land from erosion and to enhance natural character of area.



Seedling
Poplars

1st STAGE
Bear Berry
Wax Myrtle
Red Cedar

2nd STAGE
Black Berry
White Pine
Choke Cherry

3rd STAGE
Northern Red Oak
Red Oak
Sugar Maple

1st STAGE
Poplars
Willows
Sand Cherry
Beach Grasses

2nd STAGE
Poison Ivy
Bitter Sweet
Black Berry
Bear Berry
Red Cedar

3rd STAGE
Choke Cherry
White Pine

4th STAGE
Northern Red Oak
Red Oak

Pond Weed
Wild Celery

OLD SAND PLAIN
Later Stages or
Mature Forms of
Sand Plain Plants

FILLED LAGOON
Beach Grasses
Wax Myrtle
Willows
Poplars
Alders
Sumacs
Cherries
Red Maple
Elm
Pin Oak

SUB-CLIMAX STAGE
Northern Red Oak
Red Oak

CLIMAX STAGE
Sugar Maple
Hemlock
White Oak

FIGURE 2 - MAJOR BOTANICAL AND GEOLOGICAL STAGES

METHODOLOGY

Project Approach

The project approach employed for this study recognized a need to manipulate a large array of existing data at various scales and detail in order to identify the most significant and sensitive natural sites within the park. Traditional land planning techniques for the data collection phase gathered existing information in the form of maps, reports, observations of key individuals, interviews, and workshops. This information, once organized, formed the raw data base. A Geographic Information System (GIS) provided the means and flexibility to manipulate the data in a manner which if done by traditional hand overlays would have been overly cumbersome and limited. The data manipulations using the GIS command language highlighted the most significant natural sites within the park. These sites were then translated to the existing topographic base map for the park, thus delineating ESAs. The ESAs were finally described and guidelines for managing each ESA were prescribed (see Figure 3 - Methodology for ESA Study).

The rationale for ESA designation has been outlined by Eagles (1984) who identifies the protection of ESAs as one necessary component of a general environmental management strategy. Underlying this approach is the belief that the planning process should protect and give priority to valuable natural elements and processes (Schwartz et al. 1976).[3]

The methodology focuses on an explicit and replicable process for the identification and recognition of high quality areas by combining weighted criteria in composite map overlays which highlight the most sensitive/significant areas within the park. This approach is particularly valid for park planning since park management may update the data over time and repeat the process based on

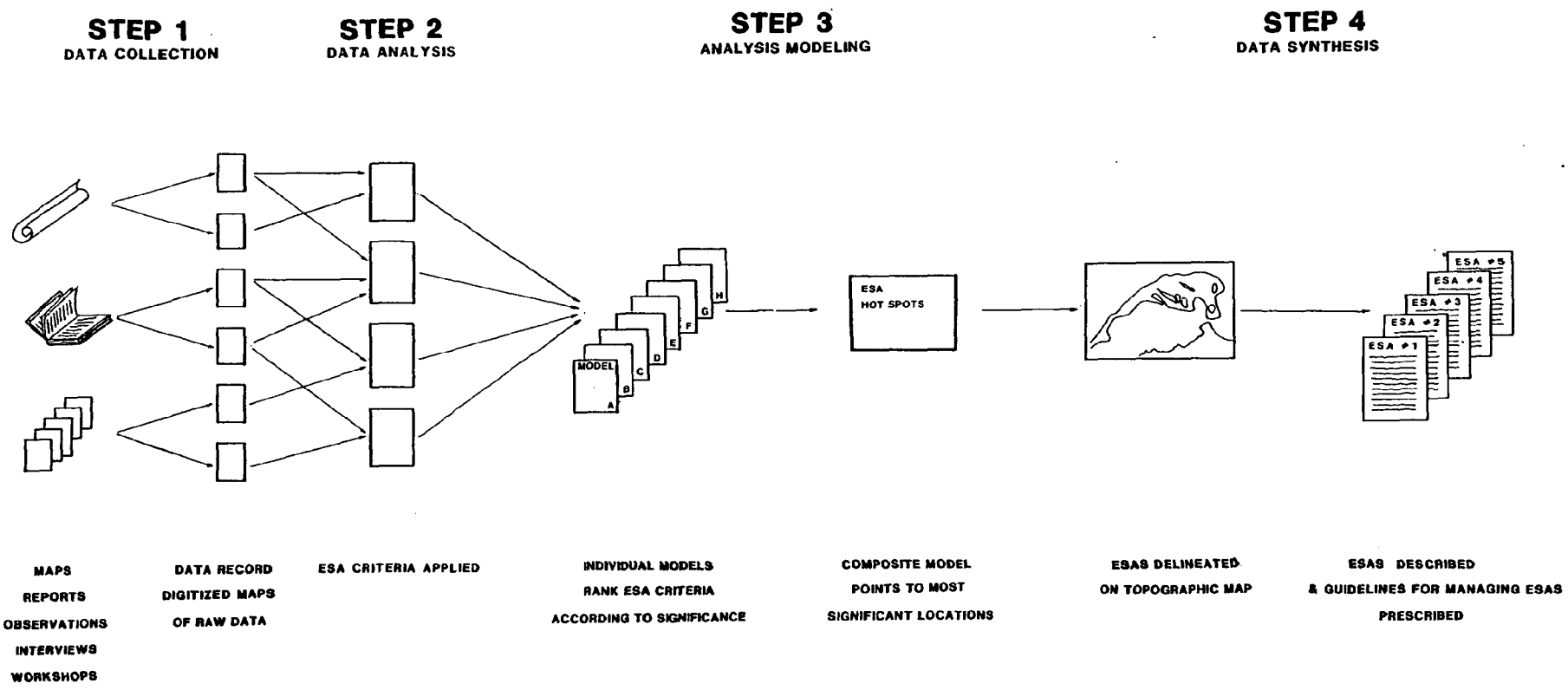


FIGURE 3 - METHODOLOGY FOR ESA STUDY

new or different data. The identification of ESAs within the park also allows park management to focus on specific submanagement units and apply appropriate management strategies.

Geographically referenced information/data is vital to this approach, in that, specific knowledge about the project area (field data) must be translatable to maps and vise versa. Each landscape feature or data item considered must have a topology, or location. The GIS provided a format to standardize the raw data in map form, i.e., translate the raw data to spatially disposed map thematic data at a standard scale geo-referenced to ground locations. Standardization of the raw data was key to the process for data from various sources to be viewed relative unto itself. Once the data was standardized, the GIS system allowed the data to be manipulated in a manner which addressed the predefined ESA criteria.

Landscape features were classified into map overlays of mutually exclusive data items and encoded to create the raw data base in the GIS. Environmental sensitivity values were then applied to recode the data items through a restructuring and combination process with other restructured data map overlays to form "models" addressing the criteria and ranking the output.

Individual models were developed for each ESA criteria. Importance was placed on data items which best addressed the ESA criteria, and data items were simultaneously ranked according to significance. A composite model added the values assigned to each model by the ranking system and provided a summary model identifying ESA hotspots with a significant number or value assigned to discrete locations within the park.

The four methodological steps of our planning process include: data collection, data analysis (data sift), analysis modeling, and data synthesis.

Step 1 - Data Collection

Step one was data collection. Geographic data is normally collected in mutually exclusive sets of data items with regard to some landscape feature or layer of information, e.g., "natural communities," to form a map. For example, the Soil Conservation Service collects data for an area and identifies soil mapping units, and the U.S. Fish and Wildlife Service collects data to delineate wetlands. Alternatively, individual data items may be aggregated from a variety of data sources to form a map overlay. An example of this type of data collection effort might be a land use overlay for historic structures collected from a variety of sources and aggregated to form one data set of information or map overlay.

The data collection process is subdivided into two major tasks. The first task is the classification of data or the naming of individual data items in a data set. This task establishes a standard nomenclature such as that used to identify species taxonomy. The second task is data encoding which is the act of transferring data as classified from field investigation or other sources to a map or coding sheet. This is a judgement call made by various professionals with expertise in a specific area of study.

A summary map displays the results of the data collection effort. The display map may be prepared at varying resolutions. Traditionally these are prepared on paper, mylar or vellum. However, with increasing frequency data is being encoded into "machine readable" forms, i.e., computer files. Some of the information collected for this project was obtained from such "digital" sources, i.e., U.S. Fish and Wildlife National Wetlands Inventory.

When not available in digital form, the required data for the identification of ESAs was put into digital form by encoding the data to a standardized base map with a uniform grid superimposed.

However collected originally, in their "raw" form, the data sets must be "standardized," i.e., translated to a common scale, for comparative analysis. A traditional approach is to create overlay transparencies for a base map. This is very effective for a simple one-shot analysis but is limited and cumbersome when dealing with complex data analyses especially when constant updating of the data will be required. Limitations are imposed by the number of transparencies which may be superimposed and the physical handling of the transparencies.

The dynamic state of Presque Isle especially justified our approach to the study utilizing a GIS system and computer models to address the ESA criteria. The analysis models which addressed the criteria may be updated by the redefinition of the raw data over time. Presque Isle is a complex ecosystem subject to extreme environmental conditions imposed by: wind, wave action, lake level fluctuations, and man-induced actions. The appearance, disappearance, and movement of the more sensitive natural communities respond in kind to these dynamic conditions. It is therefore imperative that the identification of ESAs on Presque Isle also be dynamic. For the above stated reasons this study utilized the Map Analysis Package (MAP), to capture the data, store it, manipulate it, and display it. The command languages of this GIS system is outlined in Appendix B of this report.

The base map was designed to facilitate data entry into the MAP system. The "base map" for this study was that supplied by PA DER-BSP with a 100' x 100' uniform grid superimposed. The grid is ground referenced to the State Plane coordinate System. This coordinate system has a lower scalar error and is

generally most favored by state cartographers. Some upgrades to our base map were necessary, i.e., the Gull Point area was redefined utilizing 1986 digital mapping obtained from the U.S. Fish and Wildlife Service.

When using a grid cell data structure it is necessary to define a level of resolution suitable for conducting the required analyses. The level of resolution for this project is limited to a 100' x 100' cell. The grid cell size was selected by superimposing a variety of grids over one of the most critical and important raw data maps developed for the park; i.e., the natural communities map prepared by Bissell et al., 1987. This map is also one of the most dense in terms of interpretations and classification of the data items. It was thus determined that the 100' x 100' grid was suitable to capture individual data items and show sufficient detail for ESA identification.

Step 2 - Data Analysis

The second step was data analysis. Environmentally Sensitive Areas were identified for this study by acquiring an adequate set of knowledge of the park, i.e., building a data record, to which a set of predefined criteria was applied. Acquiring knowledge about the park was accomplished during the data collection effort. Existing available information regarding the park's resources was obtained from the park's archives and included: herbarium records, published literature, unpublished scientific data, museum collections, and interviews with park researchers and park staff. In addition, workshops were held to familiarize park researchers and park staff with the approach taken by the project team and to acquire additional information and focus on particular issues (a list of participants is included in Appendix D).

The complete data record compiled and created for this project is appended to this report also (Appendix A). Twenty-nine raw data maps or map overlays are described. Sifting through this resource data was one of the first steps in constructing a model or procedure which could use this data to address the ESA criteria. This interpretation of the data is best done by an interdisciplinary process. The workshops helped in providing an initial sifting of the data. The project team then refined the information gained in the workshops and incorporated it in the analysis.

The process of sifting the data started by examining the available data with the overall objectives of the study in mind. The basic question was what map overlays can be manipulated and in what fashion to produce new mapping which addresses the ESA criteria.

Each ESA criterion takes the form of a study objective. The use of each of the park ESA criteria required the careful identification, description, analysis, and classification of the natural values of an area. It was important to recognize that Presque Isle can be considered to be significant in its totality when viewed regionally or even nationally. It already has been registered as a National Natural Landmark. However, when viewed alone it is possible to recognize areas of particular significance within the park.

The "set of defined criteria" was prepared in a study design (Phase I) preceding this effort (Phase II). Dr. Paul Eagles identified eight criteria as outlined below to be used to define ESAs. These criteria formed the basis from which the collected data was manipulated in order to apply the criteria in spatial terms, i.e. identify specific land areas relative to the criteria.

Criteria for Environmentally Sensitive Areas

The eight criteria prescribed for identifying ESAs are as follows:

CRITERION 1 (Species of Special Concern) - The area contains rare or endangered indigenous species that are extirpated, rare, endangered, threatened, or vulnerable within: the park, the state, or the country.

This criterion discusses three levels of concern: within the park (such, as prairie deer mouse), within the state (such as Blanding's Turtle) and within the country (such as the Piping Plover).

The status of the species within a park is determined by field work over a period of years. Within Presque Isle, such work has been done both by park officials and by outside researchers. Lists of species are available and the assignment of status to each species is possible.

The status of the birds, the mammals, the woody plants, the herbaceous plants, the reptiles, the amphibians, and the fish are reasonbly well known at Presque Isle. The invertebrates and non-vascular plants are not as well known but information is available from the relevant researchers. This criterion is usually applied to breeding locales of highly mobile organisms.

It is not necessary to have complete and total information on all life forms before status determination can be made. First, comprehensive information is almost never available and second, it is prohibitively expense to collect.

It should be recognized that the presence of one or several species of special concern in a locality is usually indicative of the presence of an unusual or rare community type. Therefore, the known species of special concern are often

indicators of the presence of other species that have yet to be discovered. It is for this reason that an incomplete data base is sufficient.

At Presque Isle, and in contrast to the above situation, an abundance of information exists especially for plant species of special concern.

At the park level, a rare species is defined as one that is found in five or fewer localities. An endangered park species is one that is found in two or fewer locations. A locality is defined as the location of the species as well as its immediate habitat.

At a state or national level species rarity is usually determined by the use of standard published references. The Pennsylvania Natural Diversity Inventory has determined the status of each of the indigenous species that occurs in the state. In some cases the assessment of certain groups, such as some invertebrate groups, has not been made, and therefore, the application of the park level information to the determination of state or national significance is not possible.

A special case should be made for the habitat of endangered species that appear to have been extirpated from the park. The Piping Plover is an example. This shorebird no longer breeds in the park, but as with all migratory species, it is possible that it could return in the future if the appropriate habitat is available. In such a case, designation of appropriate habitat is possible under this criteria as long as there is a reasonable amount of knowledge on the location of the previous breeding site, the appropriate habitat is still available and the designation can serve a useful conservation purpose.

Criterion 2 (Unusual and/or High Quality community) - The area has an unusual and/or high quality community with limited representation within the park, the state or the country.

The comparison of the conditions of the various habitats and communities within the park to the similar habitats and communities outside the park is necessary for the determination of status.

This criterion will be used to highlight the presence of communities that are highly natural (i.e., those at the edge of a climatic region, such as the habitat of prickily pear cactus or those that were once common but have been considerably reduced due to disturbance, such as the cranberry).

Criterion 3 (High Diversity) - The area has an unsually high diversity of species.

High diversity of species in an area is indicative of significant ecological conditions.

The presence of a large number of species in an area must be done with a good knowledge of the species numbers that are normally found in other similar habitats in that part of the country.

This criterion is applied by reference to all of the species in a community.

This criterion can be applied with specific groups of organisms as indicators. For example, a wetland with a high number of species of fish, or a woods with a high number of species of breeding wood warblers can be used to satisfy the criterion.

The use of this criterion cannot normally be done with mathematical precision. The knowledge of community composition is usually not to a sufficient level for precise numerical application. However, some populations, such as those of breeding birds and fish, are well enough known that quantitative comparative assessments are possible. In other groups only qualitative judgments can be made.

In most cases, this criterion is acceptably applied by the use of the knowledge and experience of a group of well-informed individuals.

Criterion 4 (Ecological Function) - The ecological function of the area is vital to the healthy maintenance of a natural system beyond its boundaries.

The determination of sites of vital ecological function is best done by reference to specific ecological functions. These will vary greatly in different climatic regions. The ones discussed here are most important in inland sites in northeastern North America.

Ground water and surface water are critical components of all ecosystems. The presence of areas of ground water recharge and ground water discharge are particularly important. However, in some parks that are naturally very wet due to their presence in or on a lake, the important hydrological functions are influenced by features outside the park. In these cases the determination of the location of specific, significant hydrological sites is very difficult and usually not possible.

Presque Isle is subject to lake level fluctuations which have an effect on natural communities. Factors that control the level of Lake Erie are precipitation, evapotranspiration, and runoff within the basin (Thomas et al.).

The presence of significant migratory or wintering stop-over points can be used to fulfill this criterion. However, most migratory species use broad areas of habitat for their migration stop-over points. As a result, it is important to select significant locations of importance, as opposed to general areas. An example of such an application might be a significant resting and feeding area for migratory terns, where such areas are scarce.

The biological linkage of habitats by a section of similar, but often less natural or valuable, habitat is important for the movement of individuals and species. An example here might be a break in a shore sand bar that allows access for lake fish into important inland spawning areas. An example at Presque Isle is the linkage between Misery Bay and the inland ponds.

Some species of organisms have developed breeding strategies that require them to group together during the breeding season. Colonial water birds are a good example. In most of these species the nesting area is in a well-defined, relatively small area. However, the birds forage over a much larger area. This criterion can be used to designate such colonial nesting areas because the functioning of this site is vital to the healthy maintenance of the natural system well beyond the immediate boundaries.

Other significant ecological functions may be used to fulfill this criterion in specific areas.

Criterion 5 (Large Areas) - The area is large and provides habitat for species that require extensive blocks of suitable habitat.

This criterion is used to delineate areas that provide habitat for species that require extensive blocks of natural area to survive. Upper trophic level predators are examples. These animals have demanding habitat needs that are only

fulfilled by very large blocks, in the scale of hundreds of hectares, or habitat. They usually cannot survive with significant amounts of human disturbance in their range. This criterion is used to delineate habitat of this type.

Some species that require large amounts of habitat do not need all of the habitat to be natural. An example of this is the osprey that can tolerate large amounts of human activity in its feeding area. This criterion is not used to designate the entire home range of species such as this. However, it can be used to designate smaller areas that are critical to certain parts of the life cycle, such as the area of an osprey nest.

Criterion 6 (Landform) - This area is a distinctive and unusual landform.

Distinctive and unusual landform designation is done with the knowledge of the general geomorphological and geological characteristics of a park and their significance. Features to be considered for application would include those that have significance because of their unusual characteristics. Examples of the potential use of this criterion could be: rare glacial land forms, type sites of statigraphic exposure, significant erosional or depositional features, and unusual land shapes. An example in Presque Isle might be the highest sand ridges.

In keeping with the use of the criterion for designation at three levels of significance in the park, in the state, and in the country, it is important to attempt to rank the landform feature to its level of importance.

Criterion 7 (Scientific Research) - The area is significant for scientific research.

Since virtually all aspects of the environment are potential grist for the scientific mill, only those sites that have a history of scientific research are considered. As the knowledge gained at a site develops, it becomes quite important that non-planned and unnatural perturbations not disturb the environment. Such a happening could potentially endanger the long term conclusions that might be drawn from the studies. For example, studies of the predator-prey relationships of a population of unhunted animals would be endangered by the introduction of a new predator or of hunting.

This criterion can be used for a wide variety of scientific research. Examples might include: the typing of past climates through the investigation of lake sediments, processes of fire succession, long term water monitoring, herbivore and food plant relationships over time, and habitat requirements of certain sensitive species. Within Presque Isle, there is a long term study looking at the relationship between the whitetail deer and the rare hairy puccoon.

Criterion 8 (Aesthetic Area) - The combination of landforms and natural biological communities is of high aesthetic value.

Aesthetic appreciation of an environment is one of the strongest public reactions to some sensitive environments. In the context of the designation of ESAs aesthetic appreciation is defined by the inherent beauty of a site as related to its natural value.

Specific features such as scenic views over water, overlooks, stretches of wild river, pristine forests, undisturbed natural areas and impressive stands of wildflowers are all examples of the use of this criterion. Examples in Presque Isle are the scenic areas around Gull Point and the views of the lagoons from the Ridge Trail.

This criterion is only to be used in concert with at least one of the others. The site must have some scientific, ecological or geological significance in addition to its aesthetic appeal. It is possible to have man-made sites that are quite aesthetially pleasing but are of minimal ecological significance.

Step 3 - Analysis Modeling

Step three involved the creation of analysis models using the GIS command language. This process involved the manipulation of the raw data base files such that areas of greater or lessor significance could be identified and ranked. Numerical values associated with the level of significance for individual data items were assigned by renumbering the original values assigned to each data item.

Once a working knowledge of the GIS command language is obtained, the process and the logic used in the creation of these models becomes transparent. This contrasts with other techniques for handling spatial data which tend to hide or lose the logic as the analytical work progresses; as well as being very difficult to update, recreate or modify at a later date.

The process began by transforming the raw data files into eight models which addressed the eight ESA criteria. A separate model was developed for each ESA criterion. Values corresponding to the relative strength in fulfilling the ESA criteria were assigned according to a predefined method as outlined in the Phase I study design. Seven models were then combined to form a composite model identifying the most significant areas within the park or the ESA "hot spots." One of the eight criteria was not applied for reasons stated below.

These ESA "hot spots" were used in conjunction with the natural community boundaries, roads, trails, and other well-defined manmade features to fix the ESA

boundary. In addition, the cumulative values of the composite model assigned a significant number to the individual grid cells composing the ESAs. This number was also used to rank order the ESAs into categories of sensitivity as explained below.

In order to develop the ESA models it was appropriate to garner the views of experts, specialists, and park management personnel. These views/preferences were considered by the consulting team whose professional judgements were incorporated to develop models with a high level of acceptance. To obtain the views of these experts, the consulting team held interviews with park researchers and conducted workshops at park headquarters.

The workshops and interviews were important to the process in a number of ways. During the workshops, researchers and park staff were given a sense of what can be achieved with the cartographic transformation abilities available through the GIS system, i.e., what can be achieved with Map Analysis Package commands in order to transform the raw data map overlays into ESA models. The workshops and interviews also helped define what is important and allowed for the incorporation of a wider range of experience.

The ESA models A-H are described below. Each model is essentially a sensitivity map overlay. For each model the raw data in the data record was reviewed and data items identified which could be used to meet the intent of the model. Sensitivity/significance was assigned by renumbering the original values of the raw data items and a value relative to sensitivity as described above was assigned.

A display of the result of a discrete manipulation using the GIS command language was produced as necessary to verify the resultant produced by the

manipulation before combining it in other manipulations. Displays for each model and the composite model are illustrated in the body of this text. Displays of many of the discrete data manipulations created for each model, i.e., model components/elements, are illustrated in Appendix E.

ESA IDENTIFICATION MODELS:

MODEL A (Species of Special Concern):

Program Requirement - To meet "Criterion 1" selection criteria.

Intent - To identify the spatial location of those areas within the park which indicate the presence of species of special concern at the three levels of significance, i.e., federal, state and park level significance.

Description - Component maps **FEDHAB**, **STHAB**, and **PKHAB** were created and then combined to form **MODELA**. Data record overlays (Appendix A) were reclassified assigning a relative value for level of significance. **FEDHAB** identified locations of species of special concern at the federal level. **STHAB** identified locations of species of special concern at the state level, and, **PKHAB** identified locations of species of special concern at the park level. The following describes the creation of individual components for **MODELA:**

Two animal species are "listed endangered," the Bald Eagle and the Piping Plover. One animal species is listed as a review candidate, the Eastern Sand Darter, and is included in our model as a significant species at the federal level. **FEDHAB** was created by assigning a value of 10 to important locations on Presque Isle for the above species. The locations were identified in three steps.

First, the potential nesting habitat for the Piping Plover was identified. Originally this area was identified by researcher Jean Stull on a map encoded and included in the data record (raw data files - Appendix A) as **BIRDS.** However, since the time of her mapping the Gull Point area has been reshaped. It was therefore necessary to redefine this habitat with more current data. The natural communities overlay **TEREST**, data item #01 (sparsely vegetated shifting sands/open beach), was manipulated in a configuration reflecting the intent of Jean Stull's original mapping. The result was a new overlay labeled **NEWPLOV** with the habitat area assigned a value of 01. This habitat area was then renumbered and assigned a value of 10 which created an element for **FEDHAB** label **PLOVHAB.**

Second, habitat for the Eastern Sand Darter was identified. The overlay **FISHHAB** in the data record was renumbered assigning a value of 10 to data item #01 (Eastern Sand Darter). (NOTE: All other values were assigned a value of 0) This element of **FEDHAB** was labeled **DARTHAB.**

Third, potential roosting habitat was identified for the Bald Eagle. While Bald Eagles might be expected to be sighted over the full extent of Presque Isle they prefer roosting in tall trees. Thus, the areas of Presque Isle containing the oldest and largest trees (mixed Oak, and Northern Hardwood Association) were selected from the **VEGCOVER** data record overlay, data items #01 and 02. This element of FEDHAB was labeled **EAGLEHAB.**

The **FEDHAB** component of **MODELA** was then created by the Map command "maximize" such that the input maps: **PLOVHAB, DARTHAB,** and **EAGLEHAB** created an output map (FEDHAB) identifying all locations of federal significance and assigned a value of 10 to the same.

The state status of plants and animals is listed by the Pennsylvania Natural Diversity Inventory (PNDI) for Presque Isle. Tags and tag labels used in the PNDI record description of species and their state status for Presque Isle include: PX-proposed extirpated, PE-proposed endangered, PR-proposed rare, PT-proposed threatened, N-none. Locations for species with a state status of special concern in the first four categories were identified for the **STHAB** component of **MODELA** as explained below.

Two animal species are listed as "proposed extirpated," five as "proposed threaten," and one as "tentatively undetermined." Nine species were listed as having a state status of "none" (but these are considered species of special concern at the park level). Four naiad mollusks considered to be rare/endangered species by the Western Pennsylvania Conservancy at the state level but which were tagged N in the record description include:

Leptodea fragilis, fragile paper-shell

Ligumia nasuta, eastern pond-mussel

Potamilus alatus, pink heel-splitter

Quadrula guardrula, maple-leaf

These species were considered as significant at the state level for this study.

Plant species significant at the state level are the most numerous. Three species are listed as "proposed extirpated," fifteen as "proposed endangered," eleven as "proposed threaten," ten as "proposed rare," and thirteen as "tentatively undetermined." (Bissell & Bier, Botanical Survey and Natural Community Classification for Presque Isle State Parks, December, 1987.)

STHAB was created by assigning a value of 5 to important locations on Presque Isle for species having a defined state status. These locations were identified in a manner similar to the creation of **FEDHAB**. A series of elements were first

created identifying locations of concern at the state level. These elements were then combined to form the component overlay for MODELA labeled **STHAB.** First, habitats of birds with state level significance were identified. The **BIRDS** overlay in the data base record was renumbered by assigning a value of 5 to data items #01, and 06-08 (Least and American Bitterns, Sedge Wren, Marsh Wren, Black-Crowned Night Heron, and Black Tern). This new overlay was then labeled **STBIRDS1. NEWPLOV** as described above was renumbered assigning a value of 5 to data item #01 (Common Tern and Piping Plover) and labeled **STBIRDS2.** Also, **EAGLEHAB** as described above was renumbered assigning a value of 5 to data item #10 (Bald Eagle) for an element labeled **STBIRDS3.** These elements were than combined using "maximize" creating the element **STBIRDS.**

Second, habitats of fish with state level significance were identified. The data base record overlay **FISHHAB** was renumbered assigning a value of 5 to data items #01, and 03 (Eastern Sand Darter, and juvenile Lake Sturgeon). The output overlay was labeled **STFISH.**

Third, amphibian and reptile habitats of state level significance were identified. The data base record overlay **AMPHAB** was renumbered assigning a value of 5 to data items #20 and 28 (Eastern Hognose Snake and Blandings Turtle). The output overlay was labeled **STAMP.**

Fourth, invertebrate habitats of state level significance were identified. The data base record overlay **INVHAB** was renumbered assigning a value of 5 to data base items #01 (naiad mollusks). The output overlay was labeled **STINV.**

Fifth, locations for plants of state significance were identified. Forty-three Plants of Special Concern in Pennsylvania (POSCIP) were reported from Presque Isle. They are found in the following five plant communities (IBID, Bissell & Bier, 1987):

1. Palustrine sand flats
2. Dry sand plain
3. Dunes
4. Ponds
5. Mixed emergent marshes

Since assigning state significance to the location of all of the above natural communities would virtually cover the entire extent of Presque Isle, emphasis for this study was required to identify the most significant locations. The significance of all of the natural communities on Presque Isle does highlight the fact that the entire peninsula deserves special management for the resources it contains. However, an ESA within the park is defined as the most significant and sensitive natural sites. Therefore, emphasis was placed on individual field sightings of POSCIP.

Emphasis was given by assigning importance to specific field locations as identified in the Pennsylvania Natural Diversity Inventory (PNDI). In the GIS data base one grid cell locates an area associated with a specific sighting of a species. Understanding that the "point" of sighting could occur anywhere within the grid cell and realizing potential standard error in defining the point in the field, a buffer area around the cell of an additional 100' was considered prudent in identifying these locations. **STPLANTS** was created by identifying the cell location for all sightings of plant species having state status, adding a buffer around the cell, and then assigning a value of 5 to these locations.

The **STHAB** component of **MODELA** was created by using the command "maximize" such that the input component maps: **STBIRDS, STFISH, STAMP, STINV, and STPLANTS** created an output map (STHAB) which identified locations of state significance and assigned a value of 5 to the same.

PKHAB was created by assigning a value of 1 to important locations on Presque Isle for species of special concern at the park level. These locations were identified in a manner similar to the creation of **FEDHAB and STHAB** above. A series of elements were first created identifying locations of concern at the park level. These elements were then combined to form the component overlay for **MODELA** labeled **PKHAB**.

First, habitats of birds with park level significance were identified. The **BIRDS** overlay in the data base record was renumbered by assigning a value of 1 to data items #01, and 03-08 (Least and American Bitterns, Prothonotary Warbler, Long-Eared Owl, Sedge Wren, Marsh Wren, Black-Crowned Night Heron, and Black Tern). This new overlay was then labeled **PKBIRDS1**. **NEWPLOV** as described above was renumbered assigning a value of 1 to data item #01 (Common Tern, and Piping Plover) and labeled **PKBIRDS2**. Also, **EAGLEAB** as described above was renumbered assigning a value of 1 to data item #10 (Bald Eagle) for an element labeled **PKBIRDS3**. These elements were then combined using "maximize" creating the element **PKBIRDS**.

Second, habitats of fish with park level significance were identified. The data base record overly **FISHHAB** was renumbered assigning a value of 1 to data items #01 - 04 (Eastern Sand Darter, Iowa Darter, juvenile Lake Sturgeon, and the Spotted Gar or Bowfin). The output overlay was labeled **PKFISH**.

Third, amphibian and reptile habitats of park level significance were identified. The data base overlay **AMPHAB** was renumbered assigning a value of 1 to data items #20 and 28 (Eastern Hognose Snake and Blandings Turtle). The output overlay was labeled **PKAMP**.

Fourth, invertebrate habitats of park level significance were identified. The data base record overlay **INVHAB** was renumbered assigning a value of 1 to data base items #01 and 02 (naiad mollusks and geometrid moth). The output overlay was labeled **PKINV**.

Fifth, locations for plants of park significance were identified. At this level all natural communities as outlined above were selected. The data base record overlays **AQUATIC, SANDPL, MARSH, and TEREST** were renumbered assigning a value of 1 to data items as follows: **SANDPL** data base items #01 - 10 (Palustrine sand flats) labeled as **PKPLANT1; TEREST** data base items #03 - 06 (dry open sand plain) labeled as **PKPLANT2; TEREST** data base items #01 and 02 (dunes and drift beaches) labeled as **PKPLANT3; AQUATIC** data base items #02 - 04 (ponds) labeled as **PKPLANT4; MARSH** data base items #01 - 05 (mixed emergent marshes) labeled as **PKPLANT5**. These elements were then combined using "maximize" creating the element **PKPLANTS**.

The **PKHAB** component of **MODELA** was created by using the command "maximize" such that the input component maps: **PKBIRDS, PKFISH, PKAMP, PKINV, and PKPLANTS** created an output map (PKHAB) which identified locations of park significance and assigned a value of 1 to the same.

MODELA was finally created by using the command "maximize" such that the input component maps: **FEDHAB, STHAB, PKHAB** created an output map (MODELA) which identified locations of species of special concern at three levels of significance.

Resultant - Figure 4 displays the locations on Presque Isle most significant to species of special concern. If a location is of a high level of significance, i.e., Federal Significance, it gets a value assiged to the highest level but does not receive additional points for fulfilling the state or park level significance.

FIGURE 4 - MODEL A (Species of Special Concern)

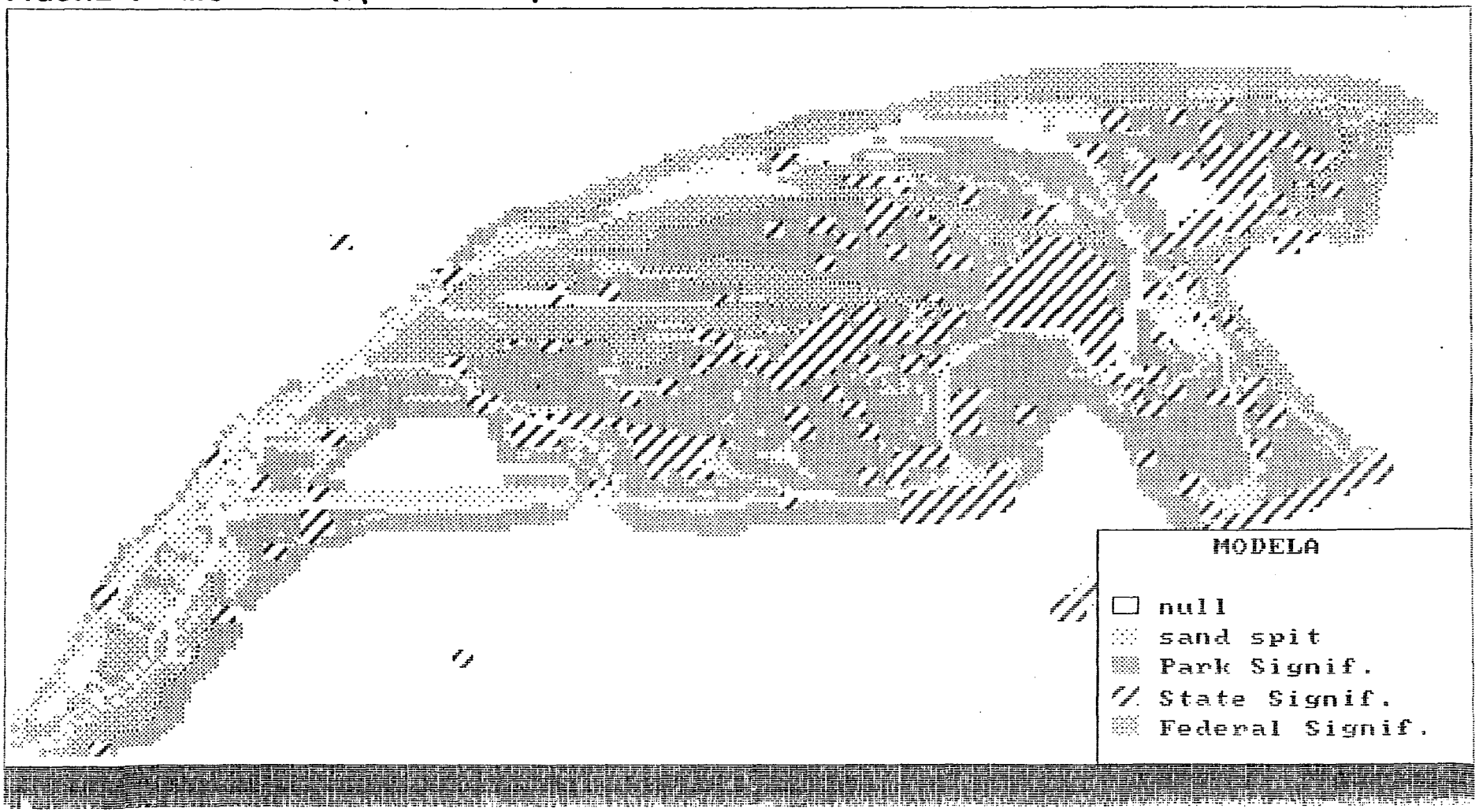
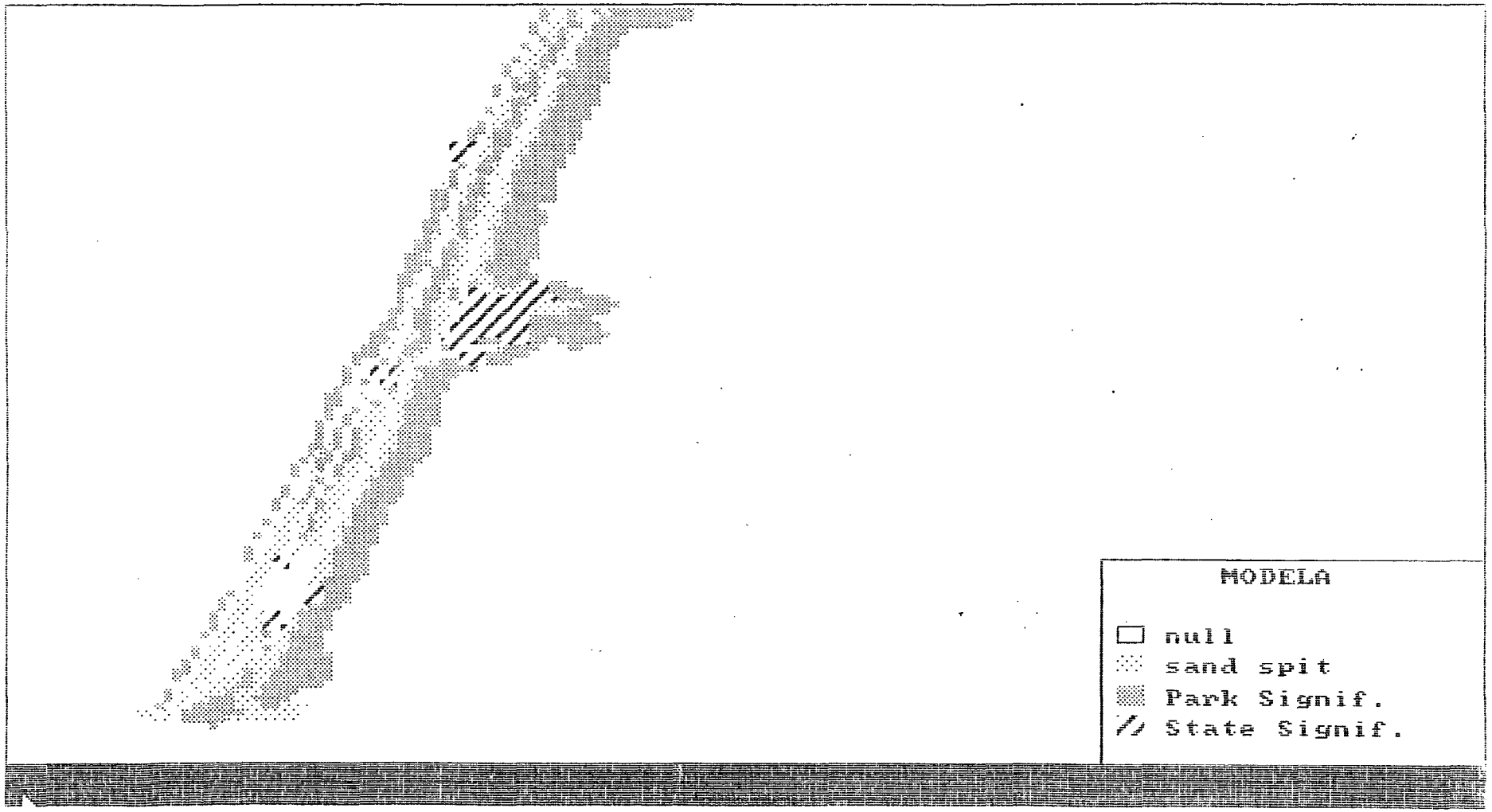


FIGURE 4b - MODEL A (Species of Special Concern)



MODEL B (Unusual and/or High Quality Community):

Program Requirement - To meet "Criterion 2" selection criteria.

Intent - To identify the spatial location of relatively undisturbed high quality natural communities with limited representation within the park, the state, or the county.

Description - Recognition of high quality natural communities is best achieved by experience over time and by persons able to compare the conditions of various habitats and communities outside the park. A cognitive map of high quality areas was produced during a workshop session by researchers intimate with the park. The map identified three levels of quality: "best, lessor, and even lessor." For the purpose of this model areas described as "best" (data item 01) were assigned a value of 10. Areas described as "lessor (data item 02) were assigned a value of 5 and areas described as "even lessor" (data item 03) were assigned a value of 1.

Therefore, the data base record overlay **HIGHQUAL** was renumbered assigning values as described above. The output overlay was labeled **MODELB**.

Resultant - Since all of Presque Isle is a National Natural Landmark and can be considered a high quality natural community at the national, state and park levels, the resultant of this model creates a relative scale within the park. Figure 5 - Model B (Unusual and/or High Quality Community) displays the spatial result of this manipulation.

MODEL C (High Diversity):

Program Requirement - To meet "Criterion 3" selection criteria.

FIGURE 5 - MODEL B (Unusual and/or High Quality Community)

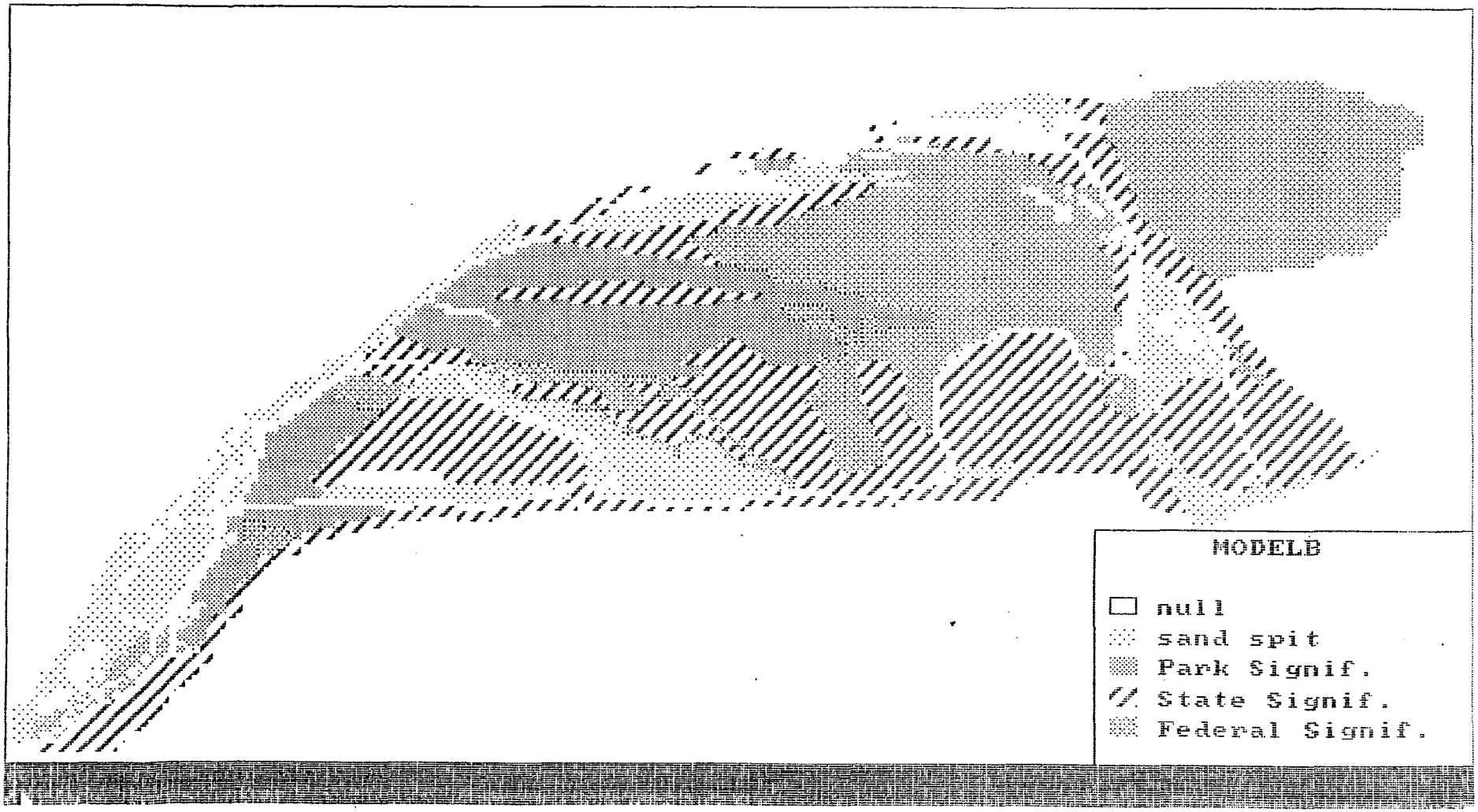


FIGURE 5b - MODEL B (Unusual and/or High Quality Community)

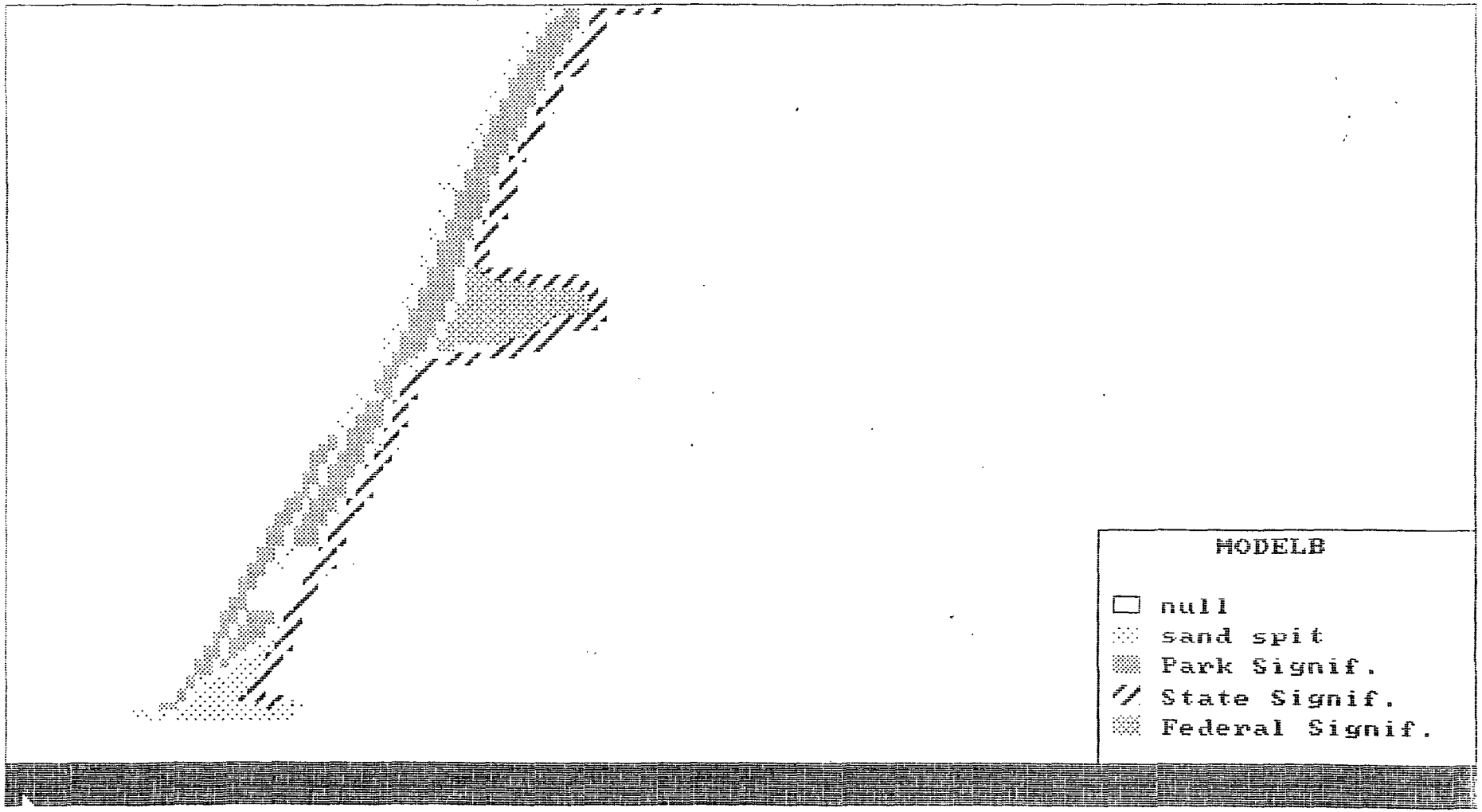


FIGURE 6 - MODEL C (High Diversity)

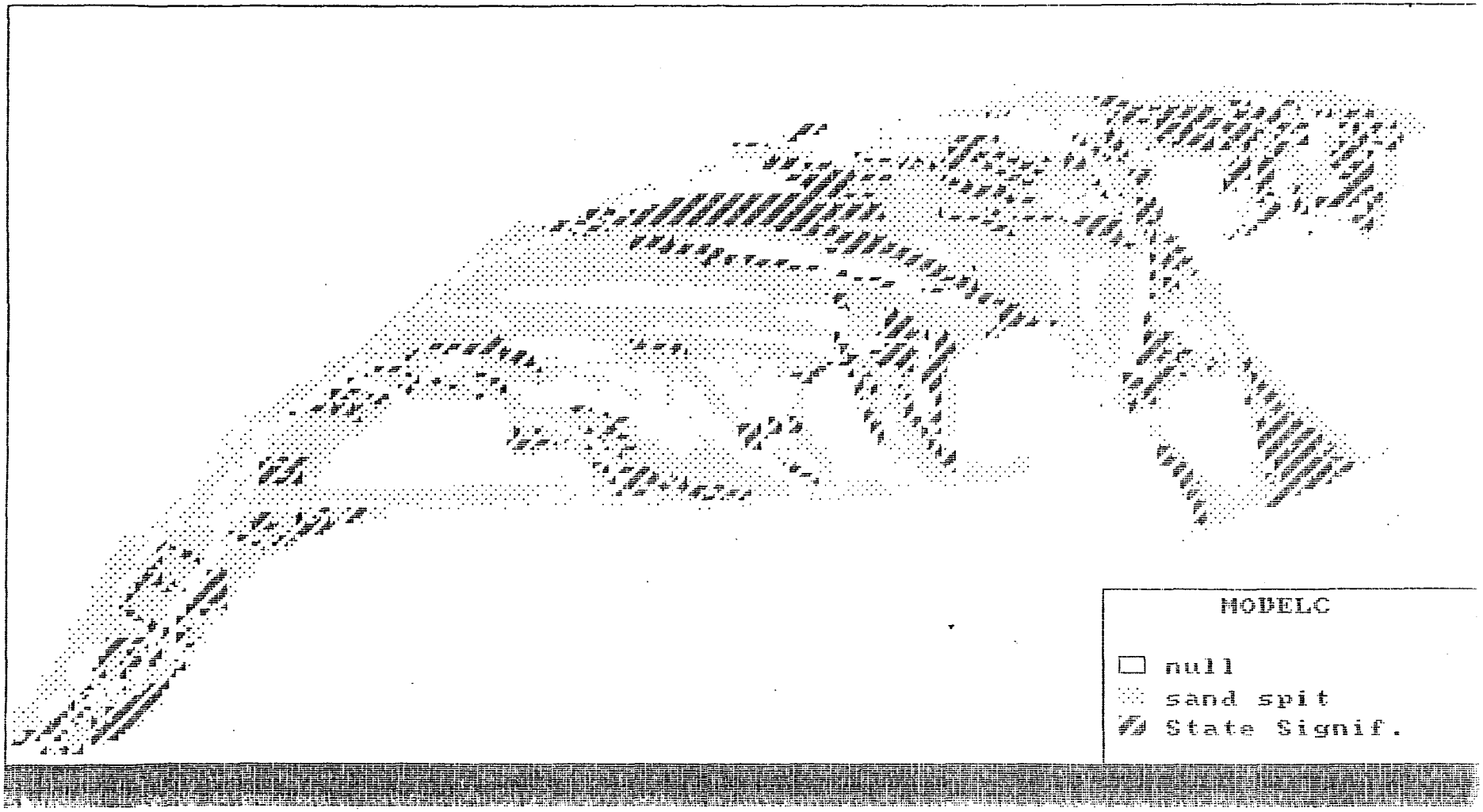
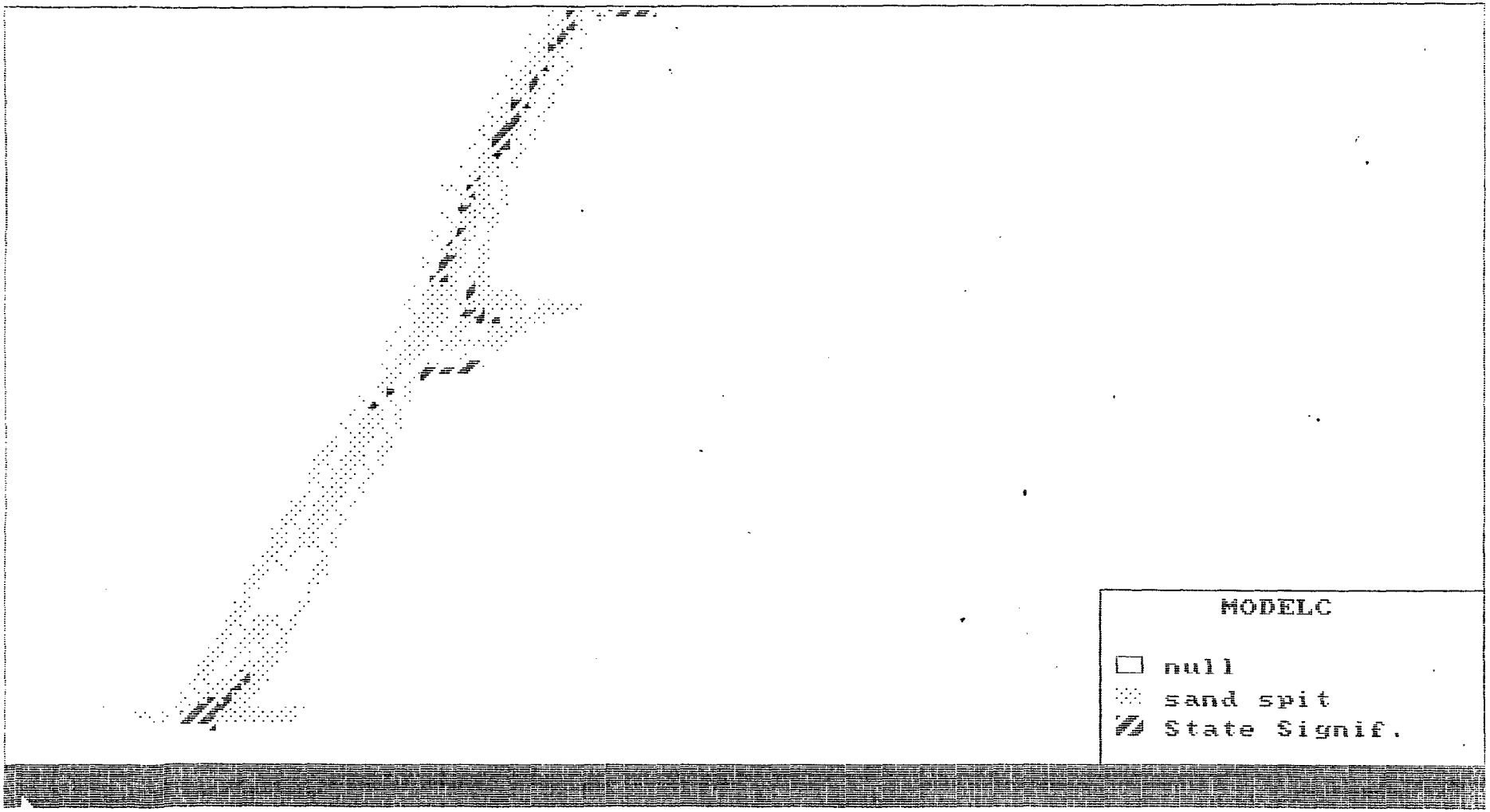


FIGURE 6b - MODEL C (High Diversity)



Intent - To identify areas having an unusually high diversity of species of special concern.

Description - The "Botanical Survey and Natural Community Classification for Presque Isle State Park," (December, 1987 - Bissell, et al.) noted the following: Eighteen POSCIP were documented in the palustrine sand plain. Five POSCIP species were found within the dry sand plain. Nine POSCIP occurred within the dunes and drift beaches. Five POSCIP species were documented in the aquatic beds, and six POSCIP species were documented in the emergent marshes and ponds. From this report the palustrine sand plain stands out as a community of high diversity for plants of special concern and is indicative of significant ecological conditions. The diversity of this community may also provide habitat to other species of special concern known or unknown to this habitat. For example, the diversity of plants found in this community may provide a family of food plants around which or on which the eggs are laid for such lessor known species as the gemetrid moths.

Therefore, the data base record overlay **SANDPL** was renumbered assigning a value of 5 to data items #01-10 (Great Lakes Palustrine Sandplain) and the output overlay was labeled **MODELC**.

Resultant - Figure 6 - Model C (High Diversity) highlights the Great Lakes Palustrine Sandplain on Presque Isle.

MODEL D (Ecological Function):

Program Requirement - To meet "Criterion 4" selection criteria.

Intent - To identify areas which serve an ecological function well beyond their boundaries and are vital to the healthy maintenance of a natural system beyond these boundaries.

Description - Four ecological functions were identified and each individual area associated with a function was assigned a value of 5.

First, critical habitat for migrating birds was identified by renumbering data record overlay **CMHAB**. A value of 5 was assigned to data item 01 (Critical Migrant Habitat) and the output overlay was labeled **EFUNC1**.

Second, channel water used by juvenile Lake Sturgeon was identified by renumbering **FISHHAB** and a value of 5 was assigned to data item 03 (juvenile Lake Sturgeon). The output overlay was labeled **EFUNC2**.

Third, lagoons used by spawning fish were identified by renumbering data record overlay **NWIWET**. A value of 5 was assigned to data item 19 (Lacustrine - littoral - aquatic bed - floating - leaved - intermittently exposed). The output overlay was labeled **EFUNC3**.

Fourth, biological linkage to the lagoons used by spawning fish serves an important ecological function and was identified by renumbering **FEATURES**. A value of 5 was assigned to data item 01 (access points). The output overlay was labeled **EFUNC4**.

MODELD was created by using the command "add" such that the input component maps: **EFUNC1, EFUNC2, EFUNC3, and EFUNC4** created an output map (MODELD) which identified areas serving important ecological functions for species beyond the boundaries of Presque Isle State Park.

Resultant - Figure 7 - Model D (Ecological Function) shows areas of defined ecological function with values assigned to each function that a site serves accumulated to represent the total number of functions a site serves. Therefore, higher values show areas having multiple functions.

FIGURE 7 - MODEL D (Ecological Function)

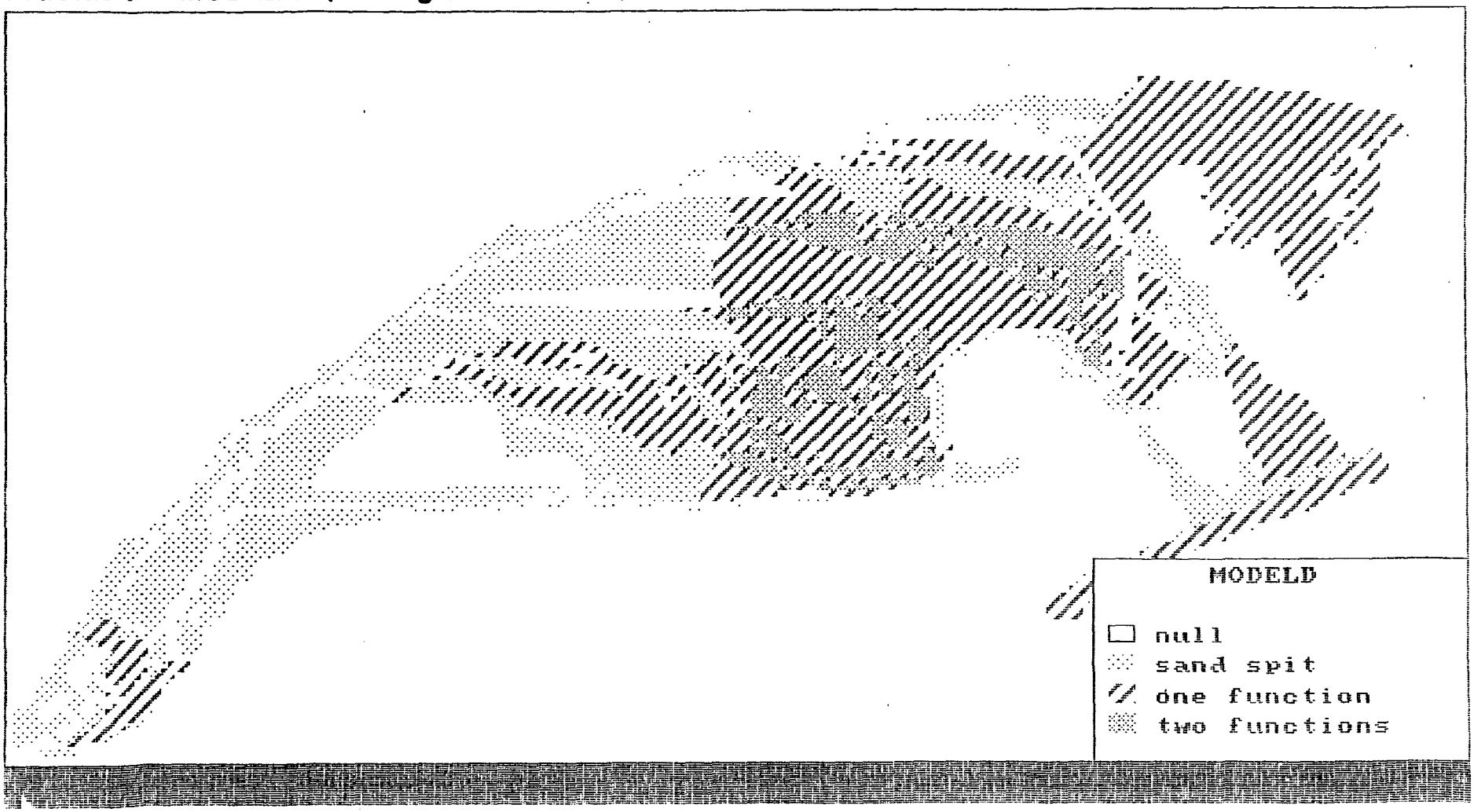
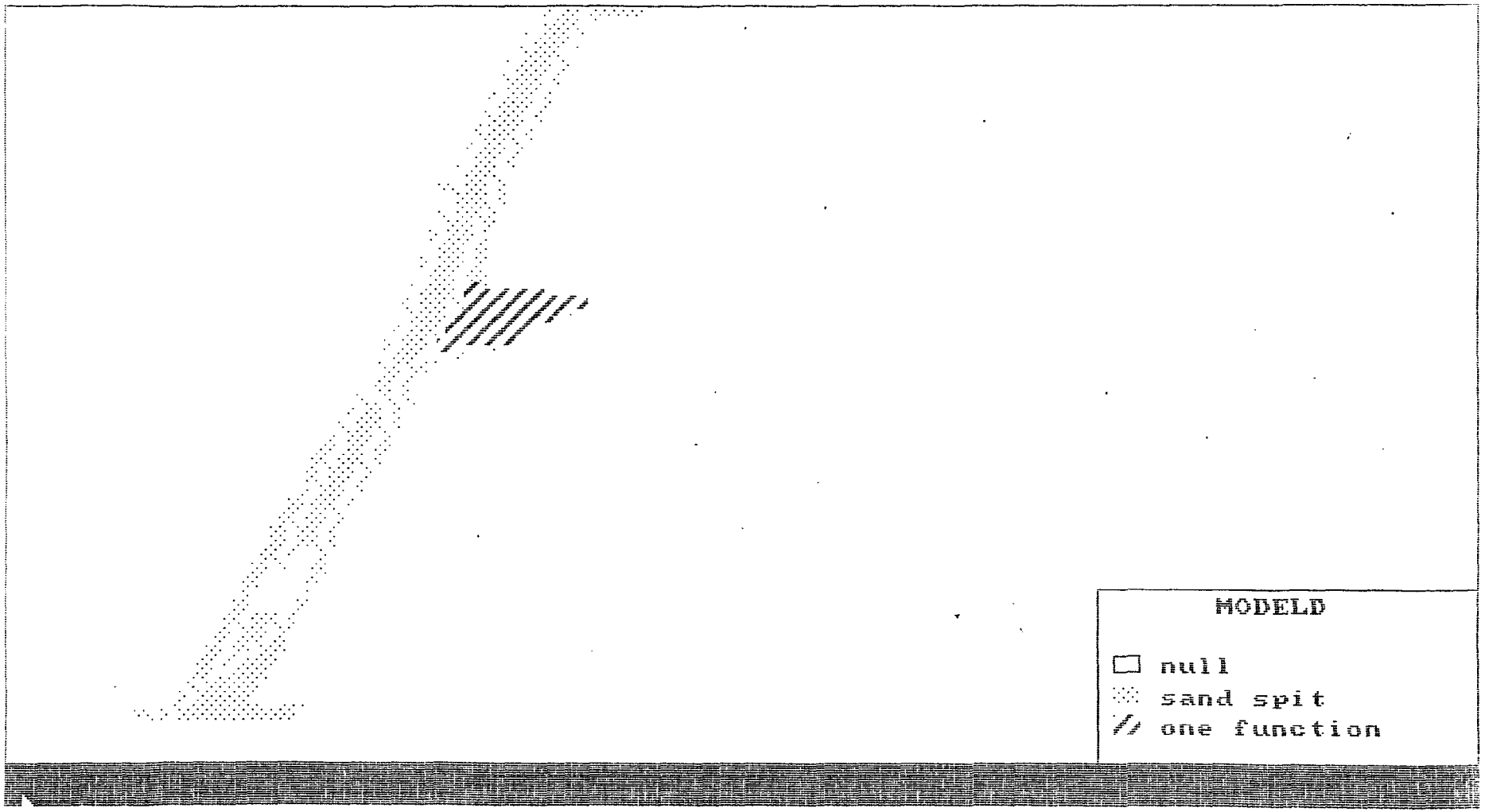


FIGURE 7b - MODEL D (Ecological Function)



MODEL E (Large Areas):

Program Requirement - To meet "Criterion 5" selection criteria.

Intent - To identify areas which provide habitat for species which require extensive blocks of habitat (a large natural community).

Description - The criterion calling for identification of areas which provide habitat for species which require extensive blocks of habitat is best addressed on Presque Isle by reference to a policy map prepared by the Presque Isle Chapter of the National Audubon Society. This map identifies significant natural areas on Presque Isle which need protection.

The data base record overlay **AUDUBON** was renumbered assigning as value of 10 to data base items 01 - 08 (Gull Point Sanctuary, Ecological Reservation, Satellite Areas I-VI). The output overlay was labeled **MODELE**.

Resultant - Figure 8 - Model E (Large Areas) highlights significant natural areas on Presque Isle identified by the Presque Isle Chapter of the National Audubon Society.

MODEL F (Landform):

Program Requirement - To meet "Criterion 6" selection criteria.

Intent - To identify areas which are significant or unusual landforms.

Description - The sand dunes of Presque Isle are unequaled geologic features within the state. The dune formations were identified by aggregating information from three data base overlays. A value of 5 was assigned indicating significance at the state level.

FIGURE 8 - MODEL E (Large Areas)

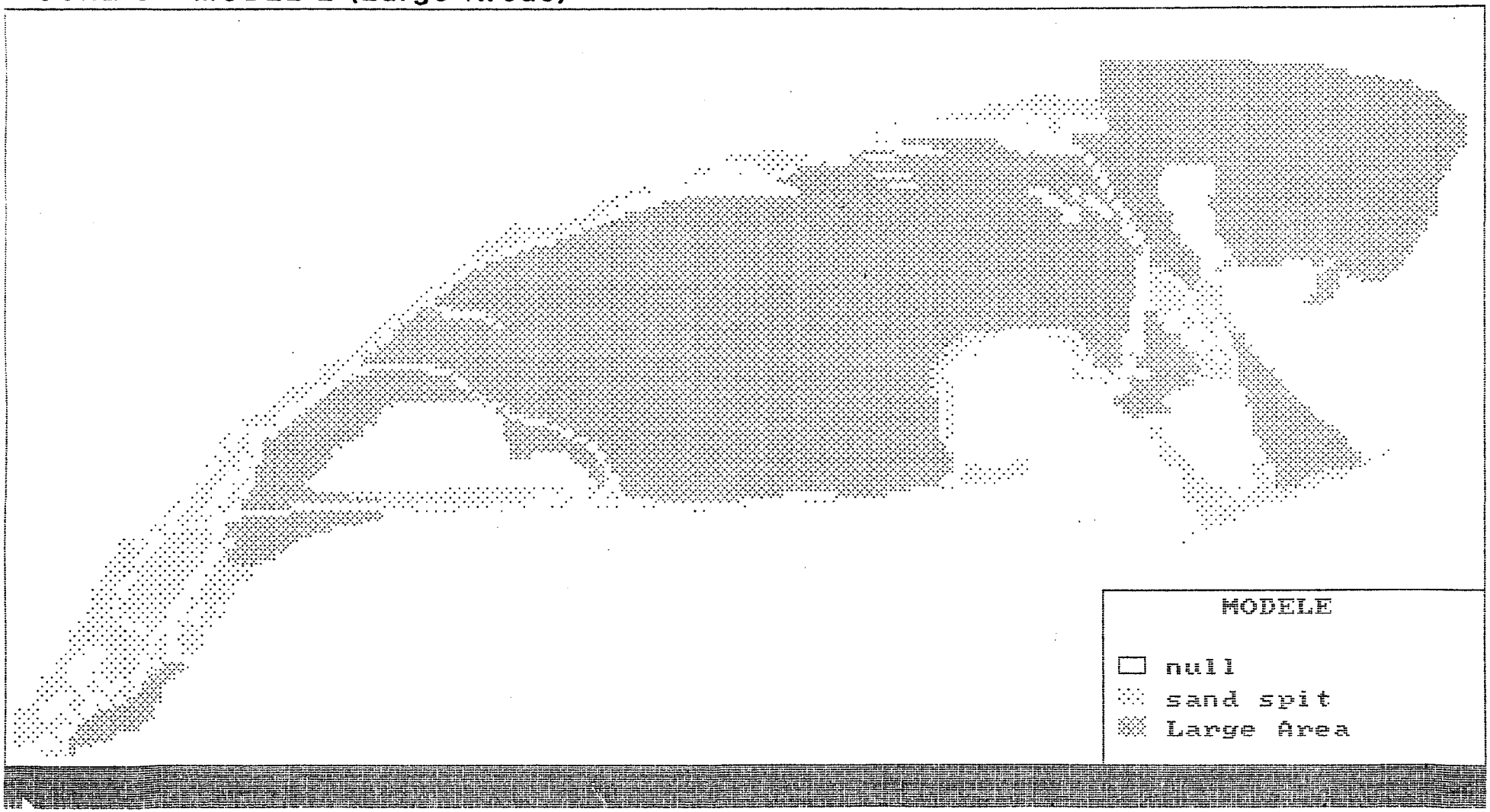


FIGURE 8b - MODEL E (Large Areas)

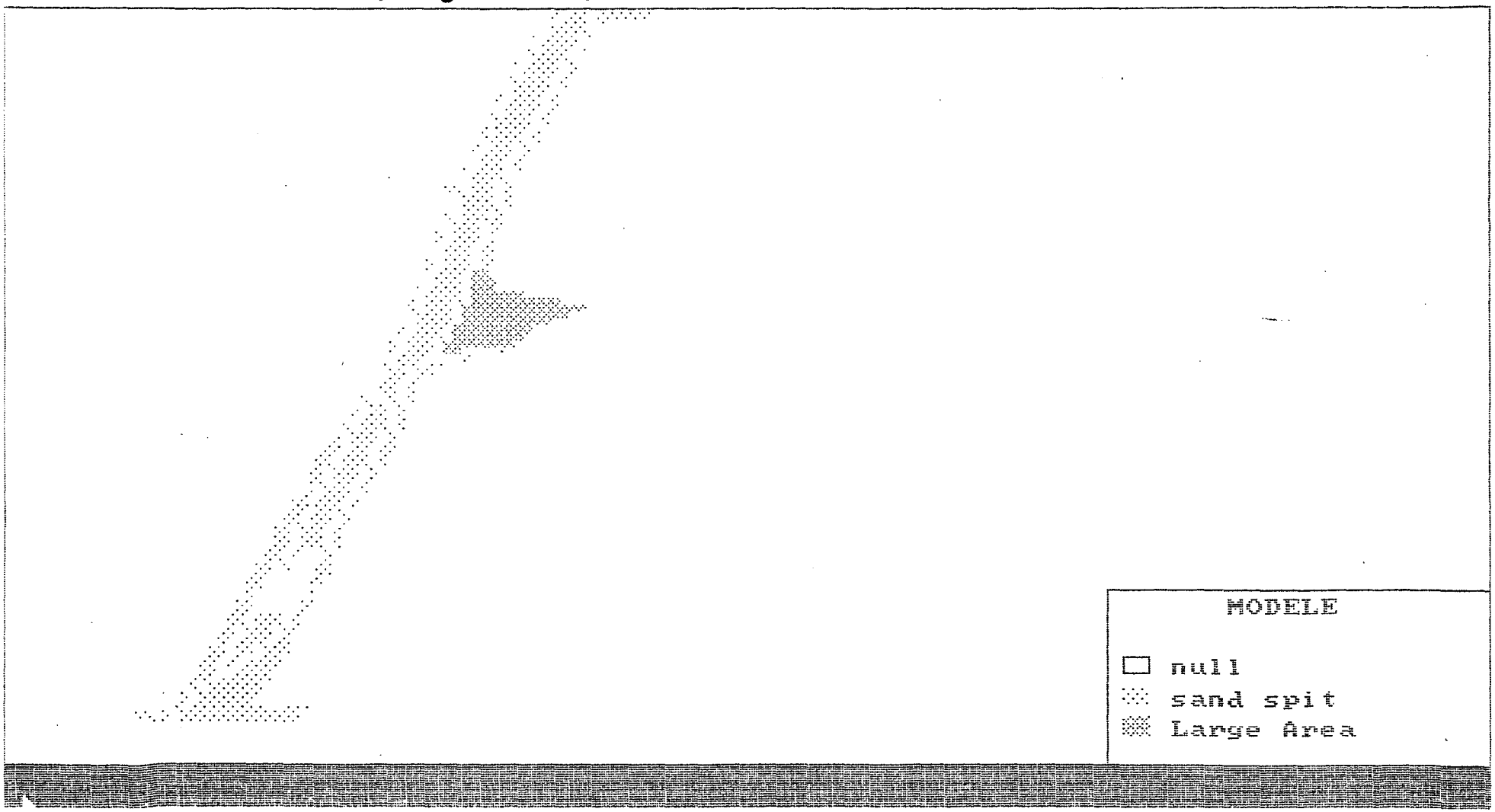


FIGURE 9 - MODEL F (Landform)

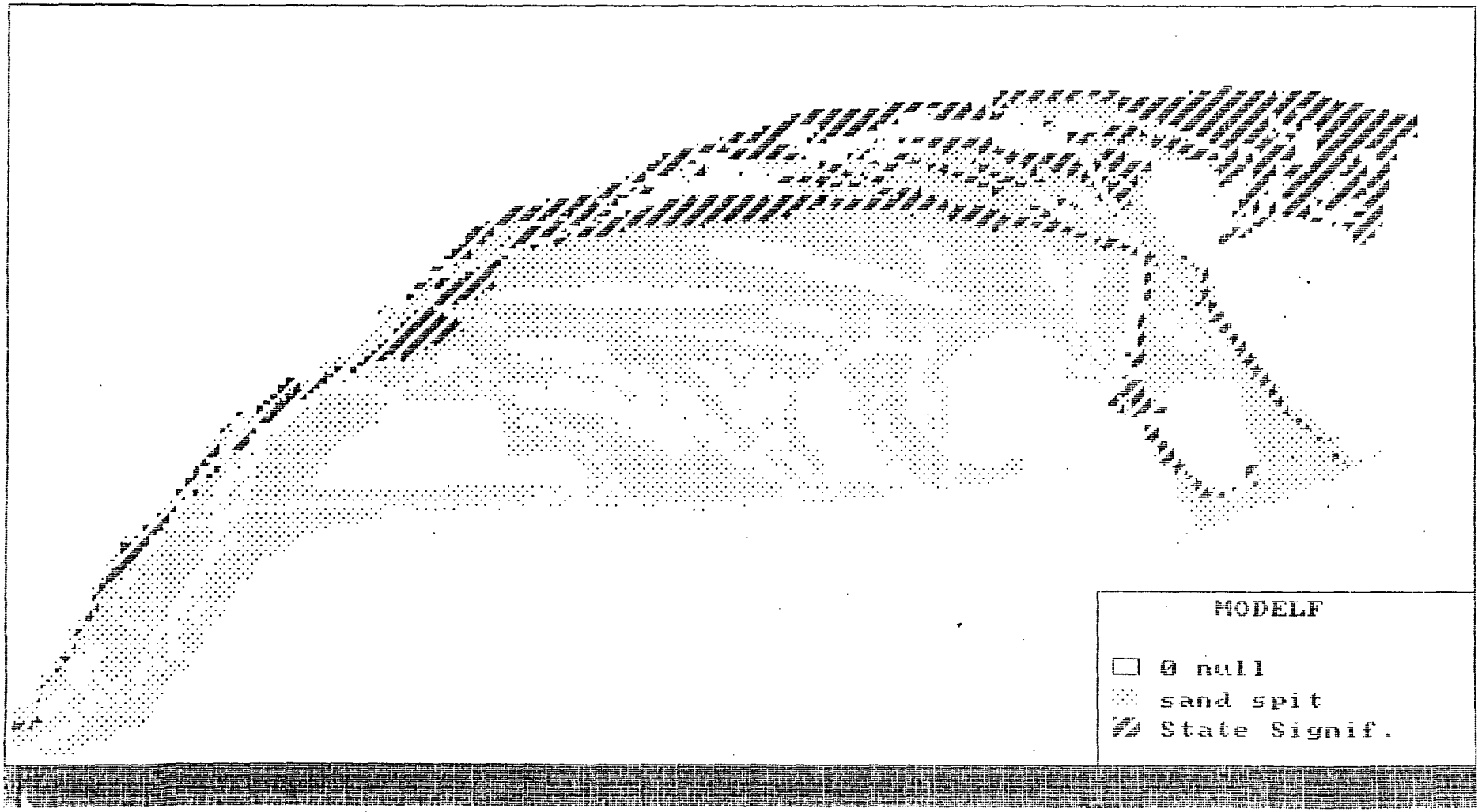
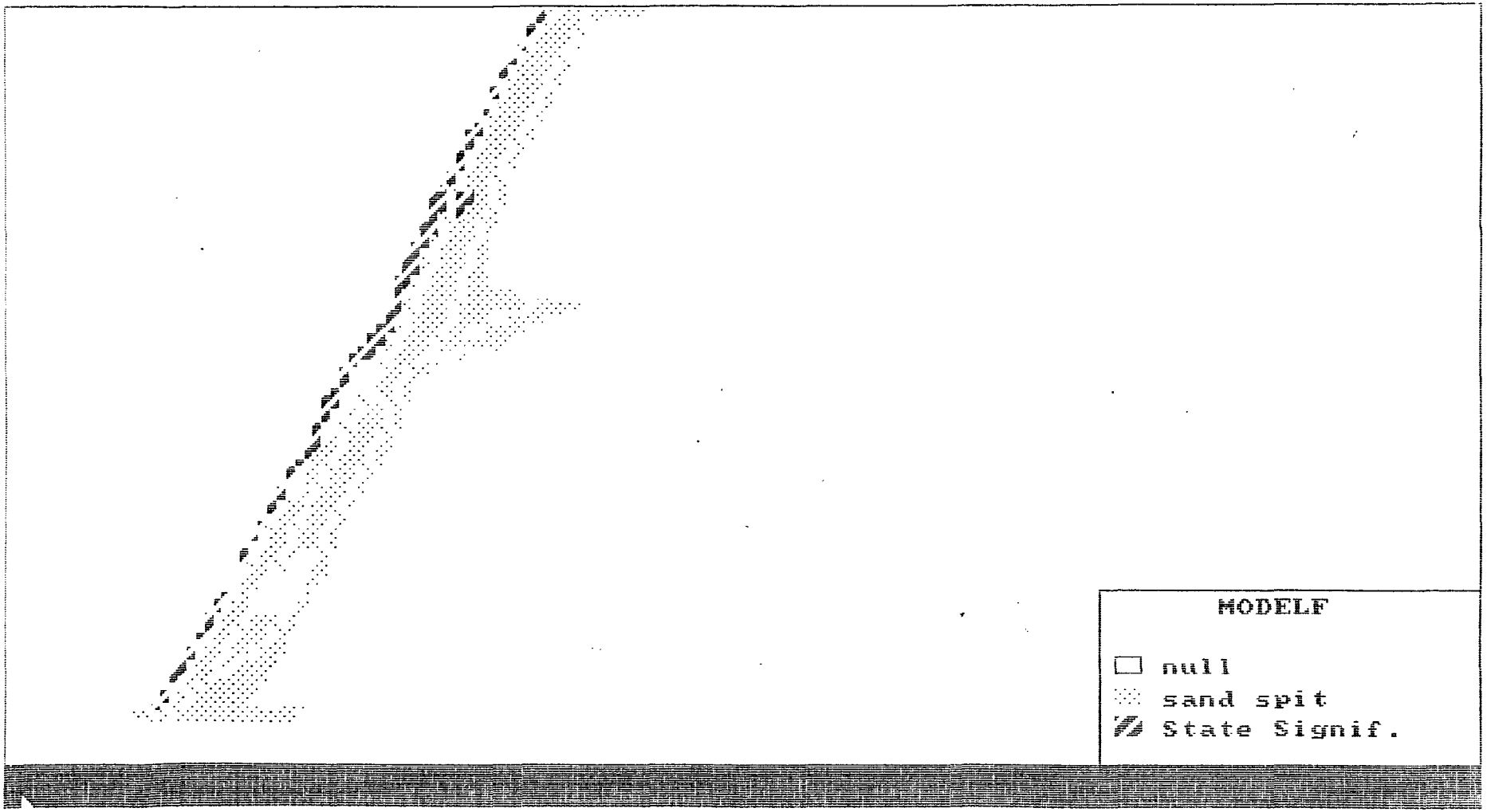


FIGURE 9b - MODEL F (Landform)



The data base overlay **LANDFORM** was renumbered and a value of 5 assigned to the data base items 01 and 02 (Old Dune-relic features, and newly forming dunes) and the output overlay labeled **FORM1.**

The data base overlay **SOILS** was renumbered and a value of 5 assigned to the data base item 03 (Dune Sand - Ds) and the output overlay labeled **FORM2.**

And, the data base overlay **TEREST** was renumbered and a value of 5 assigned to the data base items 01 and 02 (Eastern Great Lakes Beach/Dune Community) and the output overlay labeled **FORM3.**

MODELF was created by using the command "maximize" such that the input component maps: **FORM1, FORM2, and FORM3** created an output map (MODELF) which identified old and newly forming "dune" environments and assigned a value associated with state significance to the same.

Resultant - Figure 9 - Model F (Landform) highlights the sand dune formations on Presque Isle.

MODEL G (Scientific Research):

Program Requirement - To meet "Criterion 7" selection criteria.

Intent - To identify locations which are significant for scientific research, have been used over a period of time, and for which a lot of data exists. These are areas which should not be disturbed even if not a significant area in and of itself.

Description - Most locations relevant to this model are fairly straight forward and are listed in the data record overlay **RESEARCH,** however, one additional area of study less well defined spatally is the area of study for a rare plant, the Hairy Puccoon.

FIGURE 10 - MODEL G (Scientific Research)

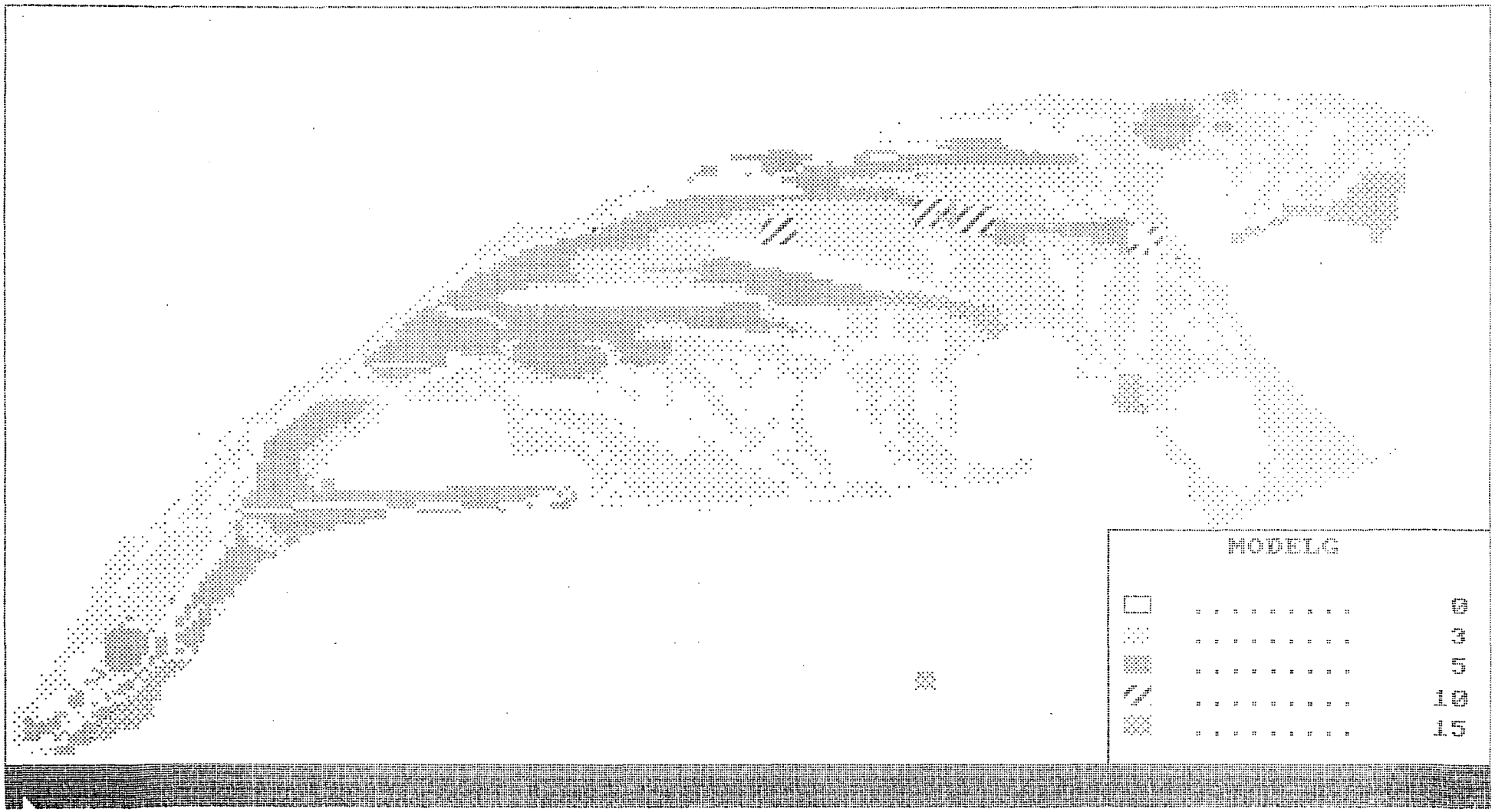


FIGURE 10b - MODEL G (Scientific Research)

A location for the Hairy Puccoon habitat was identified by first locating the cell locations for the Hairy Puccoon from the data base overlay **RPSURVEY**. Once identified the location was expanded by spreading from the cell in all directions for an assumed distance through appropriate habitats. The distance used was 500' and while it is somewhat arbitrary, it was deemed appropriate in terms of defining a reasonable and expanded habitat location as a flag for this model. The output overlay was labeled **PUCHAB** and a value of 5 was assigned to the study location identified indicating state significance.

In addition, the data base overlay **RESEARCH** was renumbered assigning a value of 10 to data base items 01 and 04 (Bird Banding Stations, and Water Quality Monitoring Stations) indicating their significance at the national level; data base items 02 and 03 were assigned a value of 1 indicating their significance at the park level. The output overlay was labeled **STUDIES**.

MODELG was created by using the command "maximize" such that the input component maps: **PUCHAB and STUDIES** created an output map (MODELG) which identified locations significant for scientific research at the three levels of significance for the study.

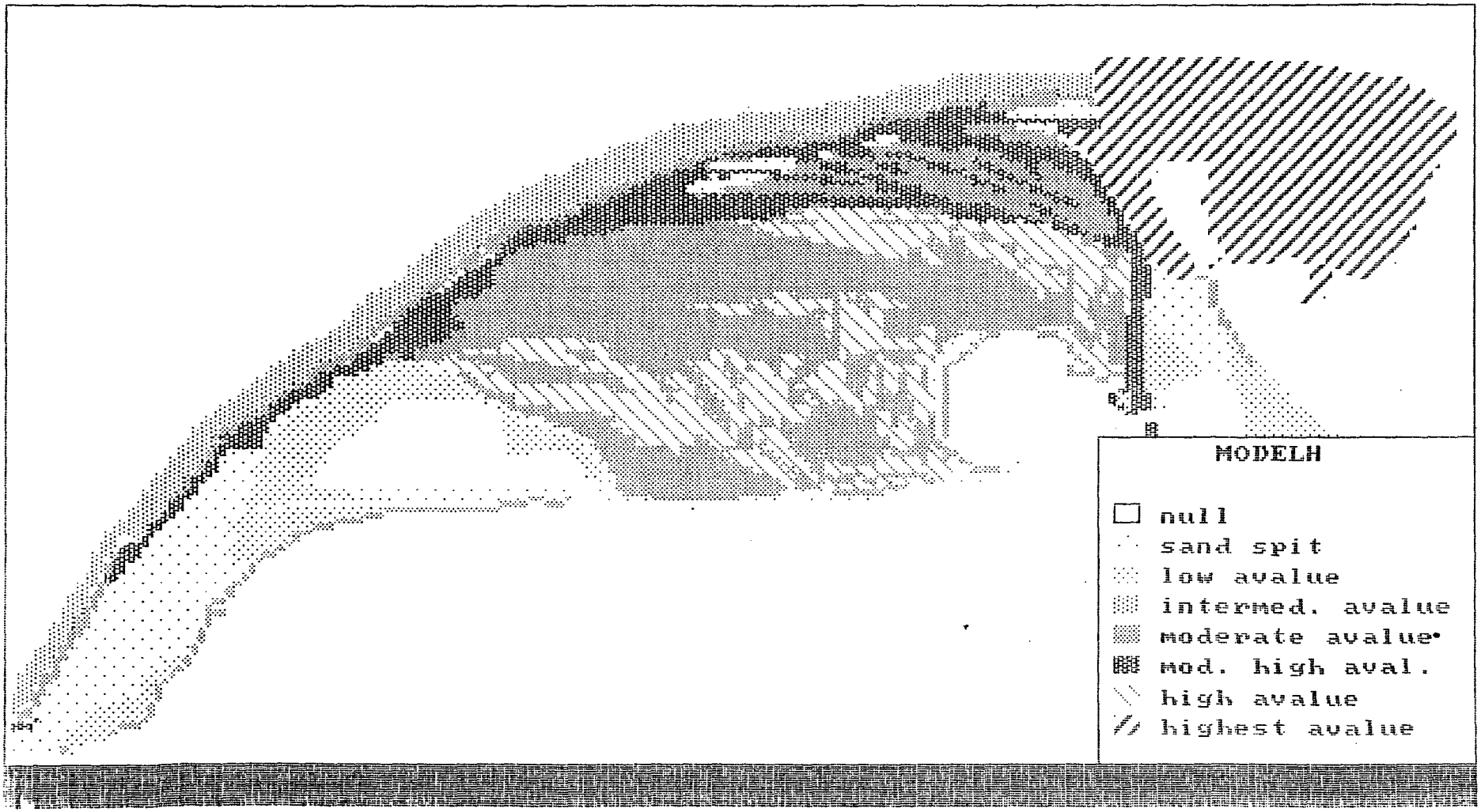
Resultant - Figure 10 - MODELG (Scientific Research) highlights the spatial location of areas on Presque Isle important to scientific research.

MODEL H (Aesthetic Area):

Program Requirement - To meet "Criterion 8" selection criteria.

Intent - To identify areas of high aesthetic value within a natural community setting.

FIGURE 11 - MODEL H (Aesthetic Area)



Description - The aesthetic value of all sites designated under this criteria was assigned comparatively. The sites with the highest value were assigned a value of 10, while all other sites with aesthetic value were assigned values from 1 to 9 below the top sites.

Resultant - Figure 11 - **MODEL H** (Aesthetic Area) shows areas of aesthetic value ranked on a scale from 1 to 10.

COMMENT: This is a very subjective model with values assigned by project team consensus and from discussions with park researchers, etc. It was felt at this time that this model was not sufficiently strong enough in terms of deciding what the best aesthetic areas were in an environment of overall aesthetic quality. For these reasons it clouds the more defineable qualities for this study; and it was decided that at this time it would be best left out of the composite model. With additional study, however, this model may be refined and run with the other models to highlight the most aesthetic areas of concern for Presque Isle State Park.

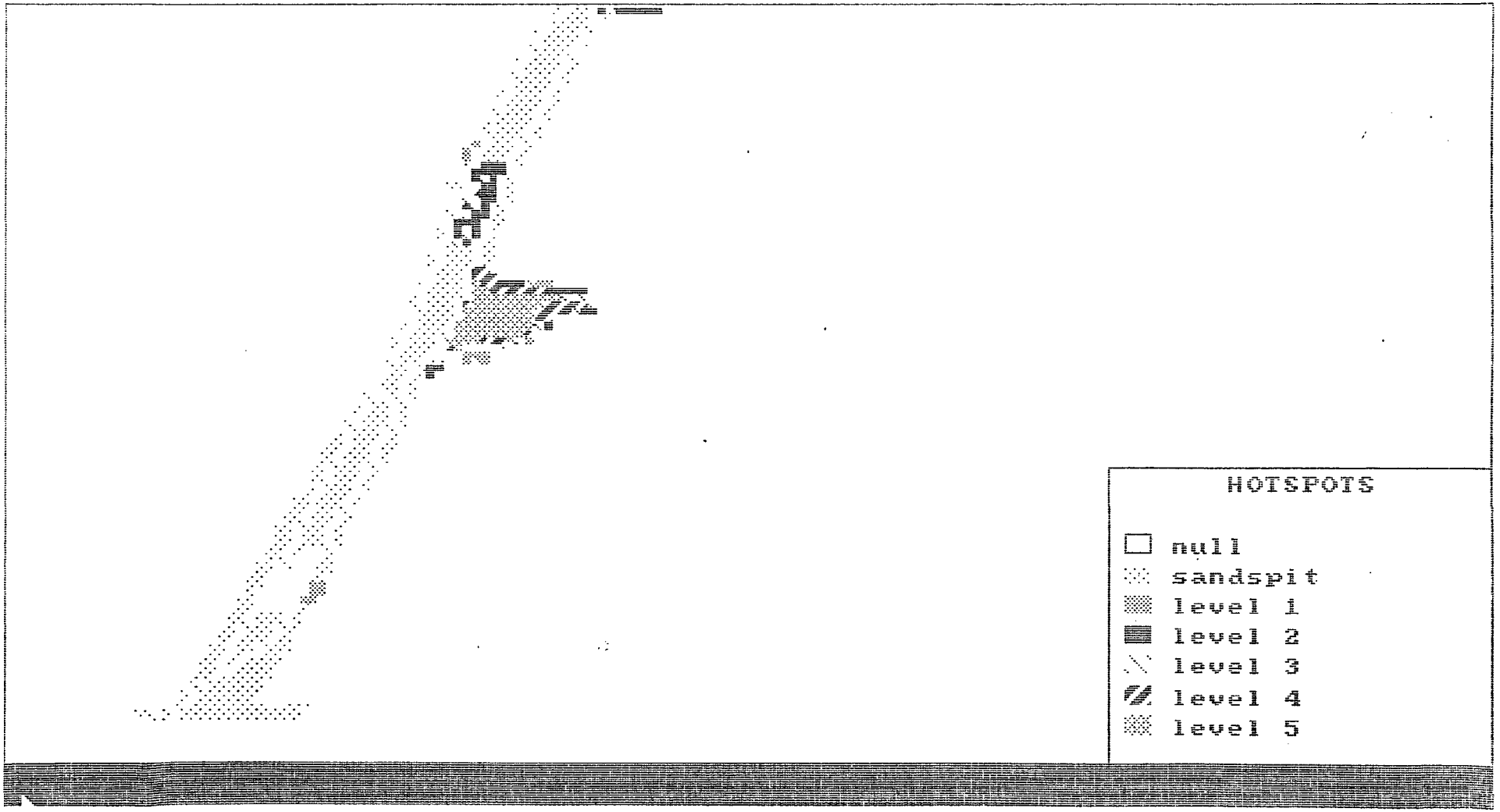
COMPOSITE MODEL:

Models addressing the ESA criteria were then combined forming a composite model, **MCOMP**, which identified the most significant areas within the park by the accumulated values of the individual models. **MCOMP** was created by using the command "add" to combine the values assigned in: **MODELA**, **MODELB**, **MODELC**, **MODELD**, **MODELE**, **MODELF**, and **MODELG**. **MODELH** was excluded. Thus, a significant number or value was assigned to specific locations within the park.

Accumulated values for **MCOMP** ranged from 0 to 55. These values were reassigned and aggregated into five categories. This aggregate map was labeled **HOTSPOTS**,

FIGURE 12 - HOTSPOTS (Model Composite)

FIGURE 12b - HOTSPOTS (Model Composite)



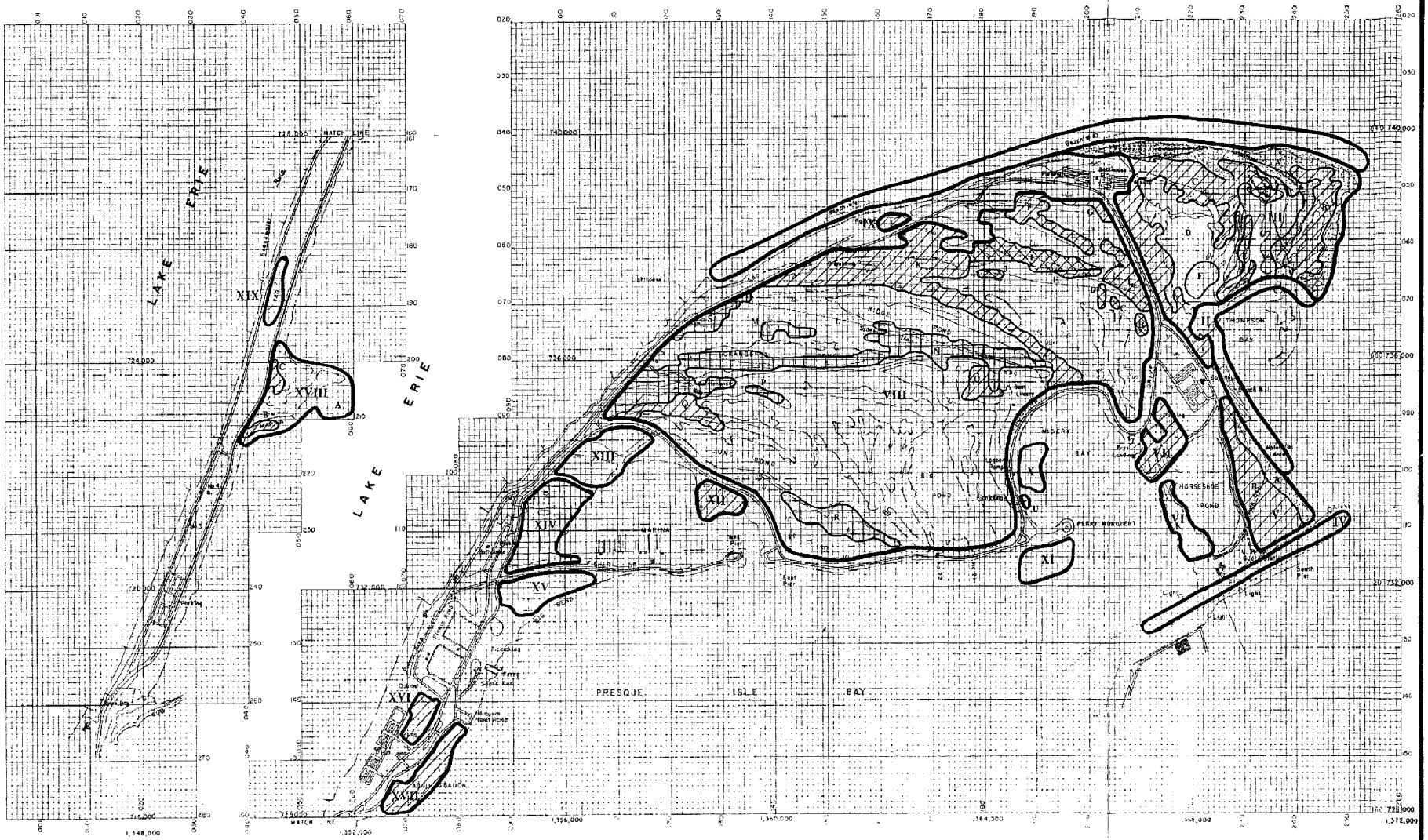
(Figure 12), and was created by renumbering the values of **MCOMP** as follows: 0 was assigned to values from 0 through 9, 1 was assigned to value 10, 2 was assigned to values 11 through 14, 3 was assigned to values 15 through 19, 4 was assigned to values 20 through 29, and 5 was assigned to values 30 through 55.

Step 4 - Data Synthesis

The final step was data synthesis. The locations highlighted by the **MCOMP** and **HOTSPOTS** models were transferred to the topographic base map prepared for the park. ESAs were identified on the topo map by correlating the ESA "hot spots" identified by the analysis models with identifiable ground features, natural community boundaries, and cultural or biological edges. The result of this effort is illustrated by Figure 13 - Environmentally Sensitive Areas for Presque Isle State Park.

ESA DESCRIPTIONS:

Summary information for each ESA is provided below and in Appendix F. Each ESA is described by a unique name related to a prominent feature within its boundaries, a short description of the location of the ESA tied to physical features, and the approximate size in acres. A general descripton of its features and an indication of the ESA criteria fulfilled is also given with a listing of species of special concern sighted within its boundaries. A complete listing of criteria fulfilled for each ESA is contained in Appendix F, ESA SCORES. Appendix F provides statistics for each ESA area scored against each individual model addressing the ESA criteria. Finally the sensitivity of each ESA is addressed by a listing of specific management considerations. The management considerations are listed by numbers associated to descriptions provided below.



Environmentally Sensitive Areas

ESA I	Transport Zone Darter	ESA VI	Horseshoe Pond Peninsula	ESA XI	Crystal Point Mollusk Bed	ESA XVI	Cabin Woods
ESA II	Bay Darter	ESA VII	Fry's Landing	ESA XII	Marina Drive Promontory	ESA XVII	Administration Backyard
ESA III	Gull Point Sanctuary	ESA VIII	Ecological Reserve	ESA XIII	Duck Pond	ESA XVIII	Old West Boat Livery
ESA IV	Lake Sturgeon Channel	ESA IX	Beach #9 Sandplain	ESA XIV	Red Maple Swamp	ESA XIX	Old Dune
ESA V	Coast Guard Flats	ESA X	Misery Bay Mollusk Bed	ESA XV	Big Bend		

RECONFIGURATION OF DISTAL END OF SAND SPIT PER 1986 DIGITAL PLOT FOR RBA MAPPING PREPARED BY U.S. FISH & WILDLIFE SERVICE. (BASE UPDATED BY THE RBA GROUP)

RECREATION / REFORMATION

EROSION

NOTE: CONTOUR INTERVAL 10 FEET.
4000-FOOT GRID BASED ON PA. COORDINATE SYSTEM, NORTH ZONE.
COMPILED BY R.S.H.M.M. ZENDT FROM U.S.C.S. QUADRANGLES & SUR-VEYS BY STATE OF PENNA

NOTE: 400 FOOT GRID BY THE RBA GROUP

Presque Isle State Park
Environmentally Sensitive Area Study

Prepared for the
Commonwealth of Pennsylvania
Department of Environmental Resources
Bureau of State Parks

Prepared by
RBA

Coastal Zone

This project was financed through a Federal Coastal Zone Management Grant from the Pennsylvania Department of Environmental Resources with funds provided by the National Oceanic and Atmospheric Administration.

SCALE IN FEET
400 0 800

FIGURE 13 - Environmentally Sensitive Areas

ESA I

Transport Zone Darter - Nearshore Lake habitat from the Lighthouse to the northeastern tip of Gull Point: waterline to 200-feet offshore.

The nearshore lake habitat occurs in waters less than six to eight feet in depth with a sandy substrate. Lake level fluctuations may expose or cover areas of The Great Lakes Palustrine Sandplain. Light House Beach, Beach #9 and Beach #10 occur within these boundaries.

The area is most significant as habitat for the Eastern Sand Darter, a review candidate for federal status and threatened in the state. Detailed life history and habitat data is not available for the Eastern Sand Darter. However, this darter has been collected along this reach of shoreline in waters ranging from approximately 10-50 feet in depth and is known to rely upon unconsolidated, sandy bottom conditions. Depending on the lake level, this area may also provide islands of habitat for up to eighteen species of special concern associated with the palustrine sand plain community.

The area is comprised of approximately 117 acres.

Species of special concern sighted include: Eastern Sand Darter

Management Considerations: 1, 2, 7, 11, 12, 19

ESA II

Bay Darter - Nearshore Lake habitat around Thompson Bay from the southern tip of Gull Point to 1000 feet south of Beach #11 ending near a concrete wall (ruin): waterline to 200-feet offshore.

The nearshore lake habitat occurs in waters less than six to eight feet in depth with a sandy substrate. Lake level fluctuations may expose or cover areas of The Great Lakes Palustrine Sandplain. Beach #11 occurs in this zone and a portion of the area is also designated for water skiing recreational use.

The area is most significant as habitat for the Eastern Sand Darter, a review candidate for federal status and threatened in the state. Depending on the lake level this area may also provide islands of habitat for up to eighteen species of special concern associated with the palustrine sand plain community. In addition to providing habitat for Eastern Sand Darter, limited field sightings indicate that portions of this area also support some of the naiad mollusks considered significant at the state level.

The area is comprised of approximately 32 acres.

Species of special concern sighted include: Eastern Sand Darter, Silverweed, Water Sedge, Schweinitz's Flatsedge.

Management Considerations: 1, 2, 7, 11, 12, 16, 19

ESA III

Gull Point Sanctuary - sandplain, dune, marsh and aquatic communities east of Park roads, stretching north from Beach #11, around parking lot for Beach #10 including beach area. Also, stretching south along Thompson Drive to Beach #11, and encompassing much of Thompson Bay.

This ESA currently has designation as a bird sanctuary. Our analysis models confirm and justify this designation. The area should be viewed as

a whole. It is the most dynamic area on Presque Isle as its natural communities may change overnight by storm impacts. Being at the depositional end of the spit the processes of accretion and erosion also cause major changes in the configuration of natural communities in short time periods. The dune and drift beaches provide appropriate habitat for the Piping Plover (extirpated state status).

The area is comprised of approximately 237 acres.

Species of special concern sighted include: Beach Worwood, Hispid Gromwell, Bushy Cinquefoil, Green Sedge, Bebb's Sedge, Elk Sedge, Slender Spike-Rush, Few-Flowered Rush, Four-Angled Spike-Rush, Red-Head Pondweed, larger Canadian St. John's-Wort, Beach Peavine, Silverweed, Water Sedge, Twig Rush, Umbrella Flatsedge, Richardson's Rush, Torrey's Rush, Aster-Like Boltonia, Lupine, River Bullrush, Baltic Rush, Small-Headed Rush, Piping Plover, Bowfin, Fragile papershell, Eastern Pond-Mussel, Aster-Like Boltonia, American Sea-Rocket, Nits-and-Lice, Small Sea-Side Spurge, Cranesbill, Northern Water-Milfoil, Leser Badderwort, Sand Cherry, Carolina Grass-of-Parnassus, White Water-Crowfoot, Common Tern, Flat-Stemmed Spike-Rush, Vetchling, Small-Flowered False-Foxglove.

Specific management considerations for sub management units within this ESA include:

Subunit A.

Dune & Drift Beaches - dune communities stretching around Lake-side perimeter of Point.

Management Considerations: 3, 4, 8, 9, 11, 14, 19

Subunit B.

Sandplain - Palustrine sandplain communites

Management Considerations: 3, 4, 8, 13

Subunit C.

Sandplain - Palustrine sandplain communites

Management Considerations: 3, 4, 8, 13

Subunit D.

Marsh/Aquatic - Marsh and lagoon communities

Management Considerations: 1, 2, 4, 5, 6, 7

Subunit E.

Sandplain - Palustrine sandplain communites

Management Considerations: 3, 4, 8, 9, 13

Subunit F.

Mollusk - Submerged aquatic bed

Management Considerations: 1, 2, 7, 12

ESA IV

Lake Sturgeon Channel - width of channel from Lake-side light 600-feet past Bay-side light.

The area is most significant as habitat for juvenile Lake Sturgeon considered endangered at the state level. While this area is beyond the actual boundary of the park its proximity and significance were considered important for inclusion in this study.

The area is comprised of approximately 46 acres.

Species of special concern sighted include: juvenile Lake Sturgeon

Management Considerations: 1, 12

ESA V

Coast Guard Flats - sand plain and dune communities east of the access road to the Coast Guard Station, north of the jetty, and south of Beach #11.

This area is significant in that a number of ESA criteria overlap. Composed of a large area of palustrine sand plain west of Horseshoe Pond and a longitudinal stretch of dune along its eastern boundary, the area is also critical hatitat for migrating birds. In addition, the area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society.

The area comprised of approximately 53 acres.

Species of special concern sighted include: Small Sea-Side Spurge, Beach Peavine, Richardson's Rush, Torrey's Rush, River Bullrush, Allegheny River Skimmer.

Specific management considerations for sub management units within this ESA include:

Subunit A.

Dune - Dune communities

Management Consideations: 3, 4, 8, 9, 11

Subunit B.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

ESA VI

Horseshoe Pond Peninsula - marsh and dune communities bounded by Misery Bay, Horseshoe Pond, and the Coast Guard Station.

This is a small distinct area significant largely as a palustrine sand plain community on which several specific sightings of plants of special concern have occurred. In addition the dune landform is significant at the state level.

The area is comprised of approximately 11 acres.

Species of special concern sighted include: Silverweed, Baltic Rush.

Management Considerations: 1, 2, 4, 5

ESA VII

Fry's Landing - sandplain communities bounded by Misery Bay on southwest, Horseshoe Bay on southeast, parking lot on northwest and end of access road on northeast.

This area is significant as as palustrine sandplain community as well as being the only known sighting of the Eastern Hognose Snake, a significant species at the state level. The area is also used as a bird banding station and is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society.

The area is comprised of approximately 18 acres.

Species of special concern sighted include: Eastern Hognose Snake, Larger Canadian St. John's-Wort, Umbrella Flatsedge, American Sea-Rocket, Hispid Gromwell, Bearberry Manzania, Blunt-leaved Spurge, Humped Bladderwort.

Management Considerations: 3, 4, 8, 9

ESA VIII

Ecological Reserve - sandplain, marsh/aquatic, and broadleaf communities surrounded by Park Drive loop, excluding pine plantations.

This ESA currently has designation as an ecological reserve. Our analysis models confirm and justify this designation and the area as a whole should be keep intact. The reserve is connected by waterways to Misery Bay and Marina Lake. These waterways are critical biological linkages for spawning fish. The lagoons of the reserve provide habitat for spawning fish. In the marsh and pond communities, the Black Tern and the Sedge Wren (threaten

at the state level) have been sighted in the high grass in the northwestern area of Niagara Pond. The dry open sand plain northeast of the center of the reserve has particular significance in that this is in the vicinity of a sighting for a Geometrid Moth (Idaea violacearis); and the general habitat and area of study of the Hairy Puccoon, a plant with endangered state status. Blanding's Turtle (state level significance) has been sighted in the eastern section near the maintenance facility and in the broadleaf forest community south of Long Pond.

The area is comprised of approximately 946 acres.

Species of special concern sighted include: Blanding's Turtle, Geometrid Moth, Hairy Puccoon/Hispid Gromwell, Northern Water-Milfoil, Bushy Cinquefoil, Hardstemmed Bullrush, Smith's Bullrush, Englemann's Flatsedge, Slender Spike-Rush, Few Flowered Rush, Four-Angled Spike-Rush, Swamp-Pink, Red-Head Pondweed, American Bittern, Least Bittern, Black Tern, Sedge Wren, Larger Canandian St. John's-Wort, Small Sea-Side Spurge, Beach Peavine, Silverweed, Water Sedge, Richardson;'s Rush, American Beach grass, Flat-Stemmed Pondwood, American Sea-Rocket, Lupine, Common Hop-Tree, Carolina Grass-of-Parnassus, River Bullrush, Schweinitz's Flatsedge, Baltic Rush, Small-Headed Rush, Sand Dropseed, Indian Wild Rice, Piping Plover, Bowfin, Spring Blue Darner, Fragile Papershell, Eastern Pond-Mussel, Aster-Like Boltonia, Nits-and-Lice, Cranesbill, Flat-Leaved Bladderwort, White Water-Crowfoot, Sand Cherry, Eastern Hognose Snake, Naked-Spiked Ambrosia, Button-Bush Dodder, Flat-Leaved Bladderwort, Lesser Bladderwort, Humped Bladderwort, a Naiad, Spotted Gar, Longnose Gar, Bowfin, Allegheny River Skimmer.

Specific management considerations for sub-management units within this ESA follow:

Submit A.

Marsh/Aquatic - marsh and pond communities

Management Considerations: 4, 5, 8, 9, 18

Subunit B.

Dry Sandplain - Dry, open sandplain communities

Management Considertion: 3, 4, 8, 9

Subunit C.

Dry Sandplain - Dry, open sandplain communities

Management Consideration: 3, 4, 8, 9

Subunit D.

Dry Sandplain - Dry, open sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit E.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit F.

Sandplain - Palustrine sandplain communities

Management Consideration: 3, 4, 8, 9

Subunit G.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit H.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit I.

Dry Sandplain - Dry, open sandplain communities

Management Considerations: 3, 4, 8, 9, 15

Subunit J.

Dry Sandplain - Dry, open sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit K.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit L.

Marsh/Aquatic - Marsh and pond communities

Management Considerations: 2, 4, 5, 8, 9

Subunit M.

Dry Sandplain - Dry, Open sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit N.

Broadleaf - Mature broadleaf forest communities

Management Considerations: 3, 8, 9, 10

Subunit O.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 4, 8, 9

Subunit P.

Broadleaf - Mature broadleaf forest communities

Management Considerations: 3, 8, 9, 10

Subunit Q.

Sandplain - Palustrine sandplain communities

Management Considerations: 3, 8, 9, 10

Subunit R.

Broadleaf - Mature broadleaf forest communities

Management Considerations: 3, 8, 9, 10

Subunit S.

Broadleaf - Mature broadleaf forest communities

Management Considerations: 3, 8, 9, 10

Subunit T.

Marsh/Aquatic - marsh and aquatic communities

Management Considerations: 1, 2, 4, 5, 6, 7, 8, 9

Subunit U.

Aquatic - nearshore aquatic communities

Management Considerations: 1, 2

ESA IX

Beach #9 Sandplain - sandplain community bounded by Park Drive, and pine plantations on east and west.

This is a small distinct area significant largely as a palustrine sand plain community with mature stands of broadleaf forest species.

The area is comprised of approximately 3 acres.

Species of special concern sighted include: none

Management Considerations: 3, 4, 8, 9

ESA X

Misery Bay Mollusk Bed - Submerged aquatic bed: along the western most portion of Misery Bay and north of Misery Bay Bridge along Thompson Drive for a distance of ±1000' and ± 400' west of same.

This area is significant as a location where rare bivalves (at the state level) have been found. Although they once occurred elsewhere in Pennsylvania, presently these species are only known from Presque Isle. These species might be expected in any relatively undisturbed sand/gravel substrate in waters approximately one half to three meters in depth in Presque Isle Bay or other bays sharing waters with Presque Isle or Lake Erie.

Species of special concern sighted include: Fragile Paper-Shell, Eastern Pond-Mussel, Pink Heel-Splitter.

The area is comprised of approximately 8 acres.

Management Considerations: 1, 2, 12, 16

ESA XI

Crystal Point Mollusk Bed - Submerged aquatic bed: south of the Perry Monument promontory for a distance of ±500' into Presque Isle Bay.

This area is significant as a location where rare bivalves (at the state level) have been found. Although they once occurred elsewhere in Pennsylvania, presently these species are only known from Presque Isle.

These species might be expected in any relatively undisturbed sand/gravel substrate in waters approximately one half to three meters in depth in Presque Isle Bay or other bays sharing waters with Presque Isle or Lake Erie.

Species of special concern sighted include: Fragile Paper-Shell, Eastern Pond-Mussel, Pink Heel-Splitter, Maple-Leaf, River Bullrush.

The areas is comprised of approximately 22 acres.

Management Considerations: 1, 2, 12, 16

ESA XII

Marina Drive Promontory - sandplain community south of Park Drive.

This is a small distinct area significant largely as a palustrine sand plain community. In addition, the area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society.

The area is comprised of approximately 11 acres.

Species of special concern sighted include: none

Management Considerations: 3, 4, 8

ESA XIII

Duck Pond - Marsh and aquatic communities encompassing duck pond and channel connecting with Long Pond.

This area is significant as a high quality natural community with a number of species significant at the park level. The area contains palustrine sand plain communities on which specific sightings of plants of special concern have occurred. In addition, the area is considered a "satellite

area of concern" by the Presque Isle Chapter of the National Audubon Society. The channel connecting Marina Lake to the lagoons of the ecological reserve serves an important biological link.

The area is comprised of approximately 26 acres.

Species of special concern sighted include: Bushy Cinquefoil, Flat Stemmed Pond Weed, Cyperus-Like-Sedge

Management Considerations: 1, 2, 4, 5

ESA XIV

Red Maple Swamp - Broadleaf communities lying south of Duck Pond, east of Park Drive and north of West Fisher Drive.

This area is significant as a high quality natural community with a number of species significant at the park level and an area significant at the state level. The area contains palustrine sand plain communities on which several specified sightings of plants of special concern have occurred. In addition, the area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society.

The area is comprised of approximately 37 acres.

Species of special concern sighted include: Larger Canadian St. John's-Wort, Piping Plover

Management Considerations: 3, 8, 9, 10

ESA XV

Big Bend - Marsh and sandplain communities lying south of West Fisher Drive and east of Park Drive where Presque Isle Bay shoreline curves easterly; and southeast of the Marina.

This area is significant as a high quality natural community with a number of species significant at the park level and an area significant at the state level. The area contains palustrine sand plain communities on which several specific sightings of plants of special concern have occurred. In addition, the area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society.

The area is comprised of approximately 20 acres.

Species of special concern sighted include: Hard-Stemmed Bullrush, Richardson's Rush, Aster-Like Boltonia, Nits-and-Lice, Cranesbill.

Management Considerations: 3, 4, 8, 9

ESA XVI

Cabin Woods - Sandplain communities between Park Drive, parking lot and cabin access road.

This area is significant for its stand of mature deciduous canopy cover. The area contains palustrine sand plain communities, and is critical habitat for migrating birds.

The area is comprised of approximately 10 acres.

Species of special concern sighted include: none

Management Considerations: 3, 4, 8, 9

ESA XVII

Administration Backyard - Sandplain and marsh/aquatic communities between Park Drive and Presque Isle Bay, south of the Niagra Boat Launch, excluding immediate grounds around building and parking lot but including the Lily Pond.

This area is significant as a high quality natural community with a number of species significant at the federal state and park level. The area contains palustrine sand plain communities on which several specific sightings of plants of special concern have occurred; the area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society; and the area is critical habitat for migrating birds. In addition, the area is used as a bird banding station.

The area is comprised of approximately 19 acres.

Species of special concern sighted include: Cranesbill, Lesser Bladderwort, Humped Bladderwort

Management Consideration: 3, 4, 8, 9

ESA XVIII

Old West Boat Livery - Marsh, aquatic and sandplain communities east of Park Drive.

This area is significant as a high quality natural community. The area contains palustrine sand plain communities on which several specific sighting of plants of special concern have occurred, and the area has significant offshore habitat for fish species of concern at the park level of significance. The area is considered a "satellite area of concern" by the Presque Isle Chapter of the National Audubon Society; and the area is critical habitat for migrating birds.

Area comprised of approximately 42 acres.

Species of special concern sighted include: Sedge Wren, Water Sedge, Silverweed, River Bullrush, Baltic Rush, Spotted Gar, Bowfin, Least Bittern

Specific management consideration for sub-management units within the ESA follow:

Subunit A.

Marsh/Aquatic - Marsh and aquatic communities

Management Considerations: 1, 2, 4, 5, 6, 8

Subunit B.

Sandplain - Palustrine sandplain habitats

Management Considerations: 3, 4, 8, 9

Subunit C.

Sandplain - Palustrine sandplain habitats

Management Considerations: 3, 4, 8, 9

ESA XIX

Old Dune Sandplain - dune community between Peninsula Road and Peninsula Drive north of Old West Boat Livery.

This area is significant as a landform, i.e., dune relic feature, and as a bird banding station.

The area is comprised of approximately 9 acres.

Species of special concern sighted include: none

Management Considerations: 3, 8, 13

MANAGEMENT CONSIDERATIONS FOR ESA'S:

Management recommendations are divided into general or park-wide recommendations and specific recommendations for individual ESAs as refereneced above for individual units.

General Recommendations for the Management of ESAs

1. Maintain ESAs in the largest uninterrupted and undisturbed vegetation units possible. Large areas more effectively preserve biological resources and diversity than smaller ones. Therefore, park management should strive to keep existing large areas intact and where possible, allow smaller, adjacent areas to rejoin and function as large ones. For example, unnecessary or little-used roads and trails should be allowed to revert to natural areas.

2. Create or maintain buffer zones around ESAs. Some organisms and communities are sensitive to edge disturbances even though the actual community or habitat remains intact. For example, some deeper forest species cannot tolerate the greater light levels found along forest edges. Therefore, buffer areas should be retained to protect ESA species and communities from undesirable disturbances.

3. Where human activity is anticipated, manage ESAs to control the most undesirable activity. Public appreciation of the Park and its diverse resources is desirable. However, some human activity may be detrimental to organisms and communities within the Park. For example, trails through sensitive areas should offer visitors opportunities to experience diverse ecosystems in the Park but these trails should not encourage people to ramble off and pick, trample or disturb rare or sensitive organisms. Some

areas such as nesting or breeding habitat should be put off limits during critical times of the year.

4. Maintain corridors for gene flow between ESAs. Some areas within the Park will necessarily remain separated although they are ecologically similar or virtually identical communities. Where possible, habitat corridors should be maintained to connect similar ESAs or if not possible, the gaps separating them should be managed to encourage movement or organisms from one area to the other. For instance, where a road separates two similar areas, it could be maintained without a parking strip or mowing shoulder to minimize the gap distance and maximize the opportunities for organisms to span this gap.

5. Adopt a policy regarding management of ESA's to prevent or maintain succession (e.g., controlled burns, mowing, etc.). Some communities are quite ephemeral, depending on environmental conditions which may exist for only a few months or years. The conditions governing sand plain communities such as winds, water level and beach processes are generally beyond the realm of management, but conditions governing other terrestrial communities are manipulable, such as burning, mowing, thinning, etc. Management of succession is not necessarily recommended but if it becomes park policy to preserve certain communities then such management procedures should be considered.

6. Manage ESA's to prevent encroachment by exotic species. A number of non-native plant and animal species occur within the Park. Deer populations for example have grown substantially in recent years and a decision has been taken to limit their numbers. Exotic wetlands plants, such a phragmites, have become invasive in some areas of the Park, outcompeting native

species. Management of natural succession is one debatable issue (Point 5) but encroachment of non-native species, while related, is another distinct issue and the Park should seriously consider a program to limit or eradicate exotic species which threaten organisms in ESAs.

7. Strengthen interpretive programs at the Park to emphasize the concept of ESAs. Public education through interpretation is an important component of a program to build support for the concept of Environmentally Sensitive Areas. Park graphics and environmental interpretive programs should include information on ESAs. This information should encourage appreciation of the Park, but it should not encourage disturbance of sensitive organisms.

8. Establish ESA monitoring program, using indicator species or other parameters to assess ecosystem health. Researchers currently working in the Park should be able to identify and regularly track the status of organisms which indicate the condition of sensitive communities and ecosystems. Sandplain, and aquatic communities might receive primary attention.

9. Pursue program of mitigation for identified threats to ESAs. All future physical and programmatic development in the Park should be considered in light of its potential impact on ESAs. Where development is identified that will negatively impact ESA's, measures to eliminate or mitigate these impacts should be undertaken.

10. Reduce heavy recreational use of park to encourage the return of such species as nesting eagles and the Piping Plover.

Specific Recommendations for the Management of ESAs

Many of the management recommendations are negatively prescriptive: there is an underlying assumption that if the Park were not a heavily used facility catering to multiple activities it would manage itself satisfactorily. Thus many of the management considerations involve limiting human activity to foster biological diversity. However, it should be noted that there are a few plants which may benefit from human activity.

The following recommendations have been developed and applied to ESA's and ESA Subunits:

1. Minimize or eliminate dredging or construction during critical life cycles.
2. Maintain submerged vegetation and substrate.
3. Prohibit vehicular traffic except in emergencies.
4. Limit public access to nesting sites in season.
5. Eradicate or control invasive exotic plants as recommended in Exotic Plant Species Study by J. Bissell, 1989.
6. Do not maintain channels for boating or fishing.
7. Limit power boat traffic, especially gasoline powered craft.
8. Construct no new trails.
9. Encourage use of existing trails with signage, boardwalks, fencing, etc.
10. Leave snags unless hazardous to visitors.
11. Maintain coastal processes.

12. Interagency management required.

13. Close existing trails and paths (access by permit only).

14. Install curtesy patrol during season of high activity as protection from disturbance during critical nesting periods of shore birds especially to encourage the return of Piping Plover nesting. Could be implemented through the use of trained student interns or volunteers. Also, as protection from trampling during preflowering stage of development of flora such as Brook Lobelia.

15. Provide deterrent to overgrazing of flora by deer population.

16. Protect water quality, substrate and host fish.

17. Designate "natural areas," i.e. no disturbance!

18. Maintain biological linkages.

19. Establish day-use capacity limits for public beaches to minimize disturbance to habitat.

RANKING OF ESAS:

The **MCOMP** model contains aggregate values from the ranking of the individual models. These aggregate values are expressed on a grid cell basis. For a given ESA the total value is expressed as the "score" which sums the value of all cells within the ESA. The average score results from dividing the score by the number of cells in the ESA.

The original intent of the study was to separate the ESAs into five categories. Each category containing approximately 20% of the ESAs. The ESAs with the

highest average score would be placed in "Category 1," and those with the lowest average score would be placed in "Category 5." Instead, after examining the scores, the ESAs were placed into five categories according to how the scores clustered around a demonstrated range of values.

The average score appeared to be a good overall indicator of relative importance for an ESA. However, ESA XVIII (Old West Boat Livery) was placed in Category 2 rather than Category 3 or 4 since the average score was brought down significantly by including the associated offshore habitat in its definition. Scored without this associated habitat the average score for ESA XVIII would be 26.98.

The categories are as follows:

Category 1

ESA III - Gull Point Sanctuary (ave. score = 30.85)

ESA VIII - Ecological Reservation (ave. score = 25.63)

ESA XVII - Administration Backyard (ave. score = 38.54)

ESA VII - Fry's Landing (ave. score = 24.94)

Category 2

ESA V - Coast Guard Flats (ave. score = 22.76)

ESA II - Bay Darter (ave. score = 22.39)

ESA XVI - Cabin Woods (ave. score = 21.00)

ESA XVIII - Old West Boat Livery (ave. score 17.31)

Category 3

ESA XIII - Duck Pond (ave. score = 18.90)

ESA XV - Bid Bend (ave. score - 18.83)

ESA XII - Marina Drive Promontory (ave. score = 18.39)

Category 4

ESA I - Transport Zone Darter (ave. score = 17.90)

ESA XIV - Red Maple Swamp (ave. score = 13.53)

ESA XIX - Old Dune (ave. score = 13.32)

Category 5

ESA XI - Crystal Point Mollusk Bed (ave. score 7.16)

ESA X - Misery Bay Mollusk Bed (ave. score 10.00)

ESA IV - Lake Sturgeon Channel (ave. score 10.00)

ESA VI - Horseshoe Pond Peninsula (ave. score 7.74)

ESA IX - Beach #9 Sandplain (ave. score 11.07)

The score output used to set these categories, as well as scores for each ESA scored by each analysis model, are included in Appendix F.

REFERENCES

1. Presque Isle Draft Resource Management Plan by the Commonwealth of Pennsylvania, Department of Environmental Resources, Bureau of State Parks, 1986.

2. Eagles, Paul F.J., ESA Study Design - Presque Isle State Park, prepared for PA-DER, Bureau of State Parks, 1988.

3. Schwartz, C.F., E.C. Thor and G.H. Elsmer, Wildland Planning Glossary, General Technical Report RSW-13, USDA Forest Service, Pacific Southwest Forest and Range Experiment Station, Berkley, California, 1976.

4. Eagles, Paul F.J., The Planning and Management of Environmentally Sensitive Areas, "Themes in Resource Management," Ed. by Professor Bruce Mitchell, University of Waterloo, 1984.

APPENDICES

APPENDIX A

DATA BASE RECORD

LIST OF DATA MAP OVERLAYS

AND

DESCRIPTIONS

PRESQUE ISLE STATE PARK

ENVIRONMENTALLY SENSITIVE AREA STUDY

DATA BASE RECORD

LIST OF DATA MAP OVERLAYS

FILE #	FILE NAME	DESCRIPTION
		NATURAL COMMUNITIES
001	**AQUATIC**	- Aquatic Communities
002	**SANDPL**	- Palustrine Sandplain Communities
003	**MARSH**	- Marsh/Swamp Communities
004	**TEREST**	- Terestrial Communities
		AREAS OF SPECIAL BIOLOGIAL SIGNIFICANCE (ASBS)
005	**PNDIPX**	- Pennsylvania Natural Diversity Inventory State Status: Proposed Extirpated
006	**PNDIPE**	- Pennsylvania Natural Diversity Inventory State Status: Proposed Endangered
007	**PNDIPT**	- Pennsylvania Natural Diversity Inventory State Status: Proposed Threatened
008	**PNDIPR**	- Pennsylvania Natural Diversity Inventory State Status: Proposed Rare
009	**PNDITU**	- Pennsylvania Natural Diversity Inventory State Status: Tentatively Undetermined
010	**PNDIN**	- Pennsylvania Natural Diversity Inventory State Status: None
011	**RPSURVEY**	- 1987 Rare Plant Survey (Bissell)
012	**PIFISH**	- Fishes of Presque Isle and Surrounding Waters
013	**FISHHAB**	- Sensitive Areas-Fish Habitats-Workshop Map
014	**BIRDS**	- Bird Habitat Map
015	**CMHAB**	- Critical Migrant Habitats
016	**AMPHAB**	- Amphibian Habitats
017	**INVHAB**	- Invertibrate Habitats
		AREAS OF SPECIAL ECOLOGICAL SIGNIFICANCE (ASES)
018	**NWIWET**	- Wetlands/Deepwater Habitats
019	**LANDFORM**	- Geological Features - Workshop Map
020	**AUDUBON**	- Significant Natural Areas
021	**HIGHQUAL**	- High Quality Areas - Workshop Map
022	**SOILS**	- Pennsylvania DER Resource Mangement Plan Soils Map
023	**VEGCOVER**	- Pennsylvania DER Resource Management Plan Vegetation Map
024	**ALIENS**	- Alien Species of Vegetation
		SCIENTIFIC RESEARCH
025	**RESEARCH**	- Areas of Scientific Research

LIST OF DATA MAP OVERLAYS - continued

PHYSICAL FEATURES

026 - **ROADS** - Transportation Routes
027 - **HISTORIC** - Historic Structures/Sites

BASE MAPS

028 - **PLANBASE** - Pennsylvania DER Resource Management Plan Base Map (updated by RBA)
029 - **BYTH** - NOAA Map/Bythemtry

NATURAL COMMUNITIES

DATA MAP OVERLAY: AQUATIC

001 AQUATIC COMMUNITIES

Description: The Presque Isle State Park Botanical Survey and Natural Community Classification (Dec. 1987) identified natural communities which were delineated by comparing high resolution colored aerial photographs (US Army Corps of Engineers 1986) and on-site field observations (38 days in 1987). Nearly 100% of the area within the park and the adjacent U.S. Coast Guard station property was visited and evaluated during the study.

The aquatic plant community is found along the bay shoreline and within open ponds in the interior sections of the park. The ponds which have well developed aquatic beds are sometimes sparsely covered with Nuphar advena, Nymphaea odorata, Brasenia schreberi and Potamogeton natans. Five aquatic bed Plants Of Special Concern In Pennsylvania (POSCIP) were documented at Presque Isle.

The following communities were mapped.

Data Items:

0 = Null
01 = Lacustrine - Eastern Great Lakes Littoral Zone (further undefiend at present)
02 = Lacustrine - Eastern Great Lakes Bay - Mixed Aquatic Bed Community (bays, large ponds)
03 = Palustrine - Eastern Great Lakes Sandspit Ponds and Bays - Mixed Aquatic Bed Community
04 = Palustrine - Eastern Great Lakes Sandspit Ponds and Bays - Non-persistent Mixed Emergent Marsh Community (Mixed Graminoid-Nuphar Community)

Information Source(s):

a. Presque Isle State Park, Botanical Survey and Natural Community Classification, Dec. 87, Cleveland Museum of Natural History, Western PA Conservancy. Date: 1986, Scale: 1:7477 (1" = 623.08)

b. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, 1988.

c. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1988.

DATA MAP OVERLAY: **SANDPL**

002 PALUSTRINE SANDPLAIN COMMUNITIES

Description: The Presque Isle State Park Botanical Survey and Natural Community Classification (Dec. 1987) identified natural communities which were delineated by comparing high resolution colored aerial photographs (US Army Corps of Engineers 1986) and on-site field observations (38 days in 1987). Nearly 100% of the area within the park and the adjacent U.S. Coast Guard station property was visited and evaluated during the study.

The palustrine sand plain is a moist sparsely vegetated sandy flat. Standing water is often present in the spring. The water table often drops below the surface during the summer. Typical sand plain species includes: Juncus articulatus, Juncus balticus, Juncus alpinus, Cyperus rivularis, Cyperus flavescens, Agalinis paupercula, Carex viridula, Carex garberi, and Hypericum majus. Eighteen Plants of Special Concern in Pennsylvania (POSCIP) were documented within the palustrine sand plain.

The following communities were mapped.

Data Items:

0 = Null
01 = Palustrine - Great Lakes Palustrine Sandplain - Mixed Herbaceous Calcareous Sandplain
02 = Palustrine - Great Lakes Palustrine Sandplain - Populus deltoides - Mixed Herb Sandplain Community
03 = Palustrine - Great Lakes Palustrine Sandplain - Shrub Savannah Sandplain Community
04 = Palustrine - Great Lakes Palustrine Sandplain - Populus deltoides - Shrub Thicket Savannah Community*
05 = Palustrine - Great Lakes Palustrine Sandplain - Calamagrostis canadensis - Mixed Herb Community
06 = Palustrine - Great Lakes Palustrine Sandplain - Calamagrostis canadensis - Myrica Savannah Community
07 = Palustrine - Great Lakes Palustrine Sandplain - Calamagrostis canadensis - Pine Plantation
08 = Palustrine - Great Lakes Palustrine Sandplain - Calamagrostis canadensis - Mixed Broadleaf - Pine Plantation Forest Community
09 = Palustrine - Great Lakes Paulstrine Sandplain - Calamagrostis canadensis - Populus deltoides - Mixed Shrub Savannah Community
10 = Palustrine - Great Lakes Palustrine Sandplain - Calamagrostis canadensis - Mixed Forest/Shrub Savannah Community

Information Source(s):

a. Presque Isle State Park, Botanical Survey and Natural Community Classification, Dec. 87, Cleveland Museum of Natural History, Western PA Conservancy. Date: 1986, Scale: 1:7477 (1" = 623.08)

b. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, 1988.

c. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1988.

DATA MAP OVERLAY: MARSH

003 MARSH/SWAMP COMMUNITIES

Description: The Presque Isle State Park Botanical Survey and Natural Community Classification (Dec. 1987) identified natural communities which were delineated by comparing high resolution colored aerial photographs (US Army Corps of Engineers 1986) and on-site field observations (38 days in 1987). Nearly 100% of the area within the park and the adjacent U.S. Coast Guard station property was visited and evaluated during the study.

The emergent wetland complex includes Typha swamp, Carex meadows, Calamagrostis marshes, non-persistent Nuphar-Nymphaea-Pontederia marshes and Acer-Quercus-Nyssa-Cephalanthus savannas with extensive mixed herbaceous marsh openings. Six Plants of Special Concern in Pennsylvania (POSCIP) were documented in marsh/swamp communities at Presque Isle.

The following communities were mapped.

Data Items:

0 = Null
01 = Palustrine - Robust/Graminoid Emergent Marsh - Mixed Robust/Graminoid Emergent Marsh Community/Carex spp. Marsh
02 = Palustrine - Robust/Graminoid Emergent Marsh - Decodon verticillatus Marsh Community
03 = Palustrine - Circumneutral Deciduous Shrub Swamp - Mixed Circumneutral Deciduous Shrub Swamp Community
04 = Palustrine - Circumneutral Deciduous Shrub Swamp - Cephalanthus occidentalis - Decondon verticillatus Community
05 = Palustrine - Circumneutral Deciduous Shrub Swamp - Mixed Broadleaf Shrub-Broadleaf Tree Swamp Savannah Community

Information Source(s):

a. Presque Isle State Park, Botanical Survey and Natural Community Classification, Dec. 87, Cleveland Museum of Natural History, Western PA Conservancy. Date: 1986, Scale: 1:7477 (1" = 623.08)

b. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, 1988.

c. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1988.

DATA MAP OVERLAY: **TEREST**

004 TERRESTRIAL COMMUNITIES

Description: The Presque Isle State Park Botanical Survey and Natural Community Classification (Dec. 1987) identified natural communities which were delineated by comparing high resolution colored aerial photographs (US Army Corps of Engineers 1986) and on-site field observations (38 days in 1987). Nearly 100% of the area within the park and the adjacent U.S. Coast Guard station property was visited and evaluated during the study.

The dry sand plain is an open, dry grassland usually dominated by Sorghastrum nutans, Panicum virgatum and Andropogon scoparius. Other species common in the sand plain include: Carex muhlenbergii, Carex tonsa, Rumex acetosella and Dichanthelium sabulorum. Five Plants Of Special Concern (POSCIP) were found within the dry sand plain communities.

Sand dunes and drift beaches at Presque Isle support nine species of Plants of Special Concern in Pennsylvania (POSCIP). Ammophila breviligulata and Populus deltoides are the most frequent dune builders, but in some areas Panicum virgatum, Andropogon scoparius and Elymus canadensis are important dune builders. Active dunes at Presque Isle are best developed from the Light House eastward to the top of Gullpoint.

The following communities have been mapped.

Data Items:

0 = Null
01 = Eastern Great Lakes Beach/Dune - Cakile edentula - Sporobolus cryptandrus Community (sparsely vegetated shifting sands-open beach)
02 = Eastern Great Lakes Beach/Dune - Ammophila breviligulata Dune Community
03 = Eastern Great Lakes Dry Mesic Sandplain - Mixed Graminoid Sandplain Community
04 = Eastern Great Lakes Dry Mesic Sandplain - Mixed Forest Sandplain Savannah/Quercus velutina-Sassafras-Prunus serotina Savannah Community
05 = Eastern Great Lakes Dry Mesic Sandplain - Shrub Thicket Sandplain/Populus deltoides-Myrica-Lonicera morrowi Community
06 = Eastern Great Lakes Dry Mesic Sandplain - Shrub Savannah Sandplain/Sorgastrum nutans Community
07 = Eastern Great Lakes Dry Mesic Sandplain - Mixed Pine Plantations - cultural, not a natural community and included here only for mapping reasons. Occurs on one of the above sandplain communities.
08 = Eastern Great Lakes Dry Mesic Sandplain - Mixed Forest - Pine Plantation
09 = Eastern Great Lakes Dry Mesic Sandplain - Great Lakes Broadleaf Sandplain Forest Populus deltoides Loam Forest Community
10 = Eastern Great Lakes Dry Mesic Sandplain - Salix fragilis-S. alba Community
11 = Eastern Great Lakes Dry Mesic Sandplain - Quercus-Prunus serotina-Acer rubrum Community

DATA MAP OVERLAY: TEREST

004 TERRESTRIAL COMMUNITIES - continued

Information Source(s):

a. Presque Isle State Park, Botanical Survey and Natural Community Classification, Dec. 87, Cleveland Museum of Natural History, Western PA Conservancy. Date: 1986, Scale: 1:7477 (1" = 623.08)

b. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, 1988.

c. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1988.

DATA MAP OVERLAYS: **PNDIPX, PNDIPE, PNDIPT, PNDIPR, PNDITU, PNDIN**

005-010 PENNSYLVANIA NATURAL DIVERSITY INVENTORY

Description: The Pennsylvania Natural Diversity Inventory, coordinated by PA D.E.R. Bureau of Forestry, is a multiple index data system which collects and manages locational, ecological, status and source information pertaining to the state's "natural resources of special concern." These resources include rare and endangered species, biological communities (natural communities), and significant examples of geologic features.

Baseline information is collected from a variety of sources, such as plant and animal specimens deposited in museums, relevant literature, graduate thesis papers, and details provided by expert biologists. This data is managed through several techniques including the plotting of localities on U.S.G.S. 7.5' quadrangles, and the creation of computerized reports describing each mapped occurrence of an endangered species, unique wetland community, etc. Presently (1987), the PNDI database contains more than 6,500 records and additional supporting data.

All plants and animals from PNDI and located at Presque Isle are listed below. Six overlays as referenced below were created in order to access species sitings according to the proposed state status and in order to avoid information loss in areas of overlap on a cell by cell basis. The value associated with each individual species remains constant for each overlay.

005 - **PNDIPX** - Pennsylvania Natural Diversity Inventory, State Status: Proposed Extirpated.

006 - **PNDIPE** - Pennsylvania Natural Diversity Inventory, State Status: Proposed Endangered.

007 - **PNDIPT** - Pennsylvania Natural Diversity Inventory, State Status: Proposed Threatened.

008 - **PNDIPR** - Pennsylvania Natural Diversity Inventory, State Status: Proposed Rare.

009 - **PNDITU** - Pennsylvania Natural Diversity Inventory, State Status: Tentatively Undetermined.

010 - **PNDIN** - Pennsylvania Natural Diversity Inventory, State Status: None.

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS)

Data Items:	Federal Status	Proposed PA Status
0 = Null		
ANIMALS		
01 = American Bittern	None	Threatened
02 = Least Bittern	None	Threatened
03 = Bald Eagle	Listed Endangered	Endangered
04 = Piping Plover	Listed Endangered	Extirpated
05 = Common Tern	None	Extirpated
06 = Black Tern	None	Threatened
07 = Sedge Wren	None	Threatened
08 = Spotted Gar	None	None
09 = Longnose Gar	None	None
10 = Bowfin	None	None
11 = Eastern Sand Darter	Review Candidate	Threatened
12 = Eastern Hognose Snake	None	Tentatively Undetermined
13 = A Geometrid Moth	None	None
14 = Spring Blue Darter	None	None
15 = Allegheny River Skimmer	None	None
16 = Fragile Papershell	None	None
17 = Eastern Pondmussel	None	None
18 = Pink Heelsplitter	None	None
PLANTS		
19 = Naked-Spiked Ambrosia		Tentatively Undetermined
20 = Beach Wormwood	None	Endangered
21 = Aster-Like Boltonia	None	Rare
22 = Hispid Gromwell	None	Endangered
23 = American Sea-Rocket	None	Rare
24 = Brook Lobelia	None	Endangered
25 = Nits-And-Lice	None	Tentatively Undetermined
26 = Larger Canadian St. John's-Wort	None	Threatened
27 = Button-Bush Dodder	None	Tentatively Undetermined
28 = Bearberry Manzanita	None	Extirpated
29 = Small Sea-Side Spurge	None	Threatened
30 = Blunt-Leaved Spurge	None	Extirpated
31 = Lupine	None	Rare
32 = Beach Peavine	None	Threatened
33 = Vetchling	None	Tentatively Undetermined
34 = Cranesbill	None	Tentatively Undetermined
35 = Northern Water-Milfoil	None	Endangered
36 = Flat-Leaved Bladderwort	None	Tentatively Undetermined
37 = Lesser Bladderwort	None	Tentatively Undetermined

AREAS OF SPECIAL BIOLOGICAL SIGNIFICANCE (ASBS) - continued

Data Items:	Federal Status	Proposed PA Status
38 = Humped Bladderwort	None	Tentatively Undetermined
39 = White Water-Crowfoot	None	Tentatively Undetermined
40 = Silverweed	None	Threatened
41 = Bushy Cinquefoil	None	Endangered
42 = Sand Cherry	None	Tentatively Undetermined
43 = Common Hop-Tree	None	Rare
44 = Carolina Grass-of-Parnassus	None	Rare
45 = Small-Flowered False-Foxglove	None	Tentatively Undetermined
46 = Common Hemicarpa	None	Endangered
47 = River Bullrush	None	Rare
48 = Hard-Stemmed Bullrush	None	Endangered
49 = Smith's Bullrush	None	Endangered
50 = Torrey's Bullrush	None	Endangered
51 = Green Sedge	None	Endangered
52 = Water Sedge	None	Threatened
53 = Bebb's Sedge	None	Endangered
54 = Elk Sedge	None	Endangered
55 = Twig Rush	None	Threatened
56 = Umbrella Flatsedge	None	Threatened
57 = Englemann's Flatsedge	None	Endangered
58 = Schweinitz's Flatsedge	None	Rare
59 = Slender Spike-Rush	None	Endangered
60 = Few-Flowered Rush	None	Endangered
61 = Four-Angled Spike-Rush	None	Endangered
62 = Flat-Stemmed Spike-Rush	None	Extirpated
63 = Baltic Rush	None	Rare
64 = Small-Headed Rush	None	Rare
65 = Richardson's Rush	None	Threatened
66 = Torrey's Rush	None	Threatened
67 = Bushy Naiad	None	Tentatively Undetermined
68 = A Naiad	None	Tentatively Undetermined
69 = Swamp-Pink	None	Endangered
70 = American Beachgrass	None	Threatened
71 = Panic Grass	None	Tentatively Undetermined
72 = Fall Witch-Grass	None	Rare
73 = Sand Dropseed	None	Rare
74 = Indian Wild Rice	None	Rare
75 = Purple Sandgrass	None	Endangered
76 = Red-Head Pondweed	None	Endangered
77 = Straight-Leaf Pondweed	None	Tentatively Undetermined
78 = Flat-Stemmed Pondweed	None	Threatened

Information Source(s):

a. Pennsylvania Natural Diversity Inventory (PNDI) database printout for Presque Isle, PA. PA DER Bureau of Forestry, September, 1988.

DATA MAP OVERLAY: RPSURVEY

011 1987 RARE PLANT SURVEY

Description: The following Plants Of Special Concern In Pennsylvania (POSCIP) listed as Endangered, Threatened or Rare, were documented at Presque Isle State Park by the Botany Department of the Cleveland Museum of Natural History during the 1987 Rare Plant Survey. Locations (not specific) of those species identified during the survey were located on reductions of USGS 7½' quadrangle maps.

Data Items:	Federal Status	PA Status
0 = Null		
01 = *Carex bebbii* - Bebb's Sedge*	None	Endangered
02 = *Carex garberi* - Elk Sedge*	None	Endangered
03 = *Carex viridula* - Green Sedge*	None	Endangered
04 = *Cyperus engelmanii* - Engelmann's Flatsedge	None	Endangered
05 = *Eleocharis elliptica* - Slender Spike - Rush	None	Endangered
06 = *Eleocharis pauciflora* - Few-flowered Rush	None	Endangered
07 = *Hemicarpha mircrantha* - Common Hemicarpha	None	Endangered
08 = *Lobelia kalmii* - Brook lobelia*	None	Endangered
09 = *Potentilla paradoxa* - Bushy Cinquefoil*	None	Endangered
10 = *Lithospermum caroliniense* - Hairy Puccoon or Hipsid Gromwell	None	Endangered
11 = *Artemisia campestris* ssp. *caudata* - Beach Wormwood*	None	Endangered
12 = *Triplasis purpurea* - Purple Sandgrass*	None	Endangered
13 = *Potamogeton richardsonii* - Red-Head Pondweed	None	Endangered
14 = *Eleocharis quadragulata* - Four-Angled Spike-Rush	None	Endangered
15 = *Scirpus acutus* - Hard-Stemmed Bullrush	None	Endangered
16 = *Cyperus diandrus* - Umbrella Flatsedge	None	Threatened
17 = *Hypericum majus* - Larger Canadian St. John's-Wort	None	Threatened
18 = *Juncus alpinus* - Richardson's Rush**	None	Threatened
19 = *Juncus torreyi* - Torrey's Rush**	None	Threatened
20 = *Potentilla anserina* - Silverweed	None	Threatened
21 = *Dichanthelium sabulorum* - Panic Grass	None	Threatened
22 = *Ammophila breviligulata* - American Beachgrass	None	Threatened
23 = *Chamaesyce polygonifolia* - Small Sea-Side Spurge	None	Threatened
24 = *Lathyrus japonicus* - Beach Peavine*	None	Threatened
25 = *Carex aquatilis* - Yellow Sedge	None	Threatened

011 1987 RARE PLANT SURVEY - continued

Data Items:	Federal Status	PA Status
26 = Cladium mariscoides - Twig Rush*	None	Threatened
27 = Potamogeton zosteriformis - Flat-stem Pondweed***	None	Threatened
28 = Juncus balticus - Baltic Rush*	None	Rare
29 = Juncus brachycephalus - Small-Headed Rush	None	Rare
30 = Digitaria cognatum - Fall Witch-Grass*	None	Rare
31 = Cakile edentula - American Sea-Rocket	None	Rare
32 = Ptelea trifoliata - Common Hop-Tree	None	Rare
33 = Sporobolus cryptandrus - Sand Dropseed	None	Rare
34 = Scripus fluviatilis - River Bullrush	None	Rare
35 = Zizania aquatica - Indian Wild Rice	None	Rare
36 = Myriophyllum heterophyllum	None	Endangered
37 = Equisetum variegation	None	Endangered
38 = Agalinis paupercula*	None	Tentatively Undetermined
39 = Lathyrus palpustris	None	Tentatively Undetermined
40 = Germanium bicknellii****	None	Tentatively Undetermined
41 = Potamogeton zosteriformis	None	Tentatively Undetermined
42 = Utricularia gibba	None	Tentatively Undetermined
43 = Utricularia intermedia	None	Tentatively Undetermined
44 = Utricularia minor	None	Tentatively Undetermined

* Specie locations not documented during 1987 Rare Plant Survey, however, identified in 1988 Pennsylvania Natural Diversity Inventory database (Latitude/Longitude reference).

** Species noted as "locality loss" during 1987 Rare Plant Survey, however, identified in the 1988 Pennsylvania Natural Diversity Inventory.

*** Specie location not documented during 1987 Rare Plant Survey, however, mapped by the Cleveland Museum in 1987 (Jim Bissel's Comment Letter 12/13/88), and identified in the Pennsylvania Natural Diversity Inventory.

**** Species later classified as Extirpated in 1987 Rare Plant Survey, Appendix 3 and location identified.

COMMENTS: Two plants found by the Museum in 1987, green water-milfoil (Myriophyllum heterophyllum) and variegated scouring-rush (Equisetum variegatum) were listed as Presumed Extirpated in PA on the POSCIP list prior to discovery by the Museum in 1987. They were classified as Endangered by definition of this circumstance.

Information Source(s):

a. Presque Isle State Park, Botanical Survey and Natural Community Classification, Dec. 87, Cleveland Museum of Natural History, Western PA Conservancy. Date: 1986, Scale: 1:7477 (1" = 623.08)

b. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, 1988.

c. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1988.

d. James K. Bissell Workshop Comment Letter, December 13, 1988.

DATA MAP OVERLAY: PIFISH

012 FISHES OF PRESQUE ISLE AND SURROUNDING WATERS

Description: The following species represent those listed in Pennsylvania as Species of Special Concern (1985) located at Presque Isle as concluded in the study "Fishes of Presque Isle State Park and Surrounding Waters" (R. Kenyon and F. Perise, May 1986):

Endangered

Lake sturgeon - Young specimens are occasionally reported in Presque Isle Bay by anglers and adult specimens have been reported caught and released by commercial fishermen in Lake Erie, the Lake Erie Research Unit of the Pennsylvania Fish Commission (PFC) and one 179 cm total length (aged 40+ years by fin ray section) specimen washed ashore at North East, Pennsylvania in 1975.

Threatened

Silver chub - This species has been reported caught annually in U.S. Fish and Wildlife Service population assessment exercises in the western basin of Lake Erie. Only one specimen has been reported since 1971 in eastern Lake Erie.

Eastern sand darter - Reproducing populations still exist along the shores of eastern Lake Erie and most probably near or within Presque Isle, although its numbers must be greatly diminished.

Vulnerable

Spotted gar - Trap net surveys and other Presque Isle Bay and peninsular water fish collection exercises still find this species. Attempts should be made to quantify or otherwise define this specie's present abundance. Presque Isle Bay and peninsular habitats are apparently the only areas of its Pennsylvania distribution.

Bowfin - There is need to place this species on the vulnerable listing since the Presque Isle population appears to be one of the few self-sustaining ones which thrives in its original, Pennsylvania range. Because of its uniqueness among North American fishes, as a sole representative of the order Amiiformes, the bowfin's welfare in Pennsylvania, especially at Presque Isle, should be of elevated concern.

Iowa darter - This glacial relict is now limited to only two other locations in Pennsylvania outside of Presque Isle. Because of this and its restriction habitat requirements, it is felt this species is very sensitive to habitat deterioration and vulnerable to extripation in its Pennsylvania range.

FISHES OF PRESQUE ISLE AND SURROUNDING WATERS - continued

It is apparently "common" in peninsular waters and can be collected without too much effort. Any threat to its habitat in this ecological reserve of Presque Isle would probably weaken the vitality of this isolated population, and species, in Pennsylvania.

As is true with the other fishes listed as vulnerable, this status reflects their position in Pennsylvania. Their abundance in extensive ranges outside this state precludes otherwise imminent danger for these animals. If their habitat is maintained, repopulation of their kind in Pennsylvania will not be denied because of a lack of an outside source of their species.

Status Undetermined

Mooneye - Two speciments have been verified as mooneye have been captured by anglers in Presque Isle Bay. Apparently, the species persists either in Presque Isle or, more likely, has penetrated the eastern basin as transients from western Lake Erie.

Lake herring - Since 1971, a single specimen has been captured by the PFC in Pennsylvania waters of Lake Erie. Isolated occurrences along the beaches of Presque Isle are possible in the fall and winter, although this is a form which prefers cool temperatures and deep water and consequently is not a likely inhabitant of Presque Isle Bay or peninsular waters.

Lake whitefish - The Pennsylvania Fish Commission has been able to document reproduction annually since 1971, although whitefish year classes will vary considerably in size. There still are at least 10 or more age groups in the Lake Erie population and the limited commercial catch seems to have a minimal effect on stock size. The specie's contact with Presque Isle is limited to casual excursions from its deep water habitat in spring and fall.

Because its numbers are but a fraction of its abundance in the first half of this century, the species status remains undetermined. The occasionally large yearclass, eg., 1985, seems to suggest possible rehabitation to higher levels of abundance.

The study included maps, consisting of a sketch of Presque Isle, showing areas where the species are generally located. These areas were transferred to an 800 scale grid base map.

FISHES OF PRESQUE ISLE AND SURROUNDING WATERS - continued

Data Items:	Federal Status	PA Status
0 = Null		
01 = Lepisosteus oculatus - Spotted Gar	None	None
02 = Amin calva - Bowfin	None	None
03 = Etheostoma exile - Iowa Darter	None	None
04 = Hiodon tergisus - Mooneye	None	None
05 = Acipenser fulvescens - Lake Sturgeon	None	Endangered
06 = Ammocrypts pellucida - Easter Sand Darter	Review Candidate	Threatened
07 = Hybopsis storeriana - Silver Chub	None	None
08 = Coregonus artedii - Lake Herring	None	None
09 = Coregonus clupeaformis - Lake Whitefish	None	None

Information Source(s):

a. Fishes of Presque Isle State Park and Surrounding Waters," Roger Kenyon, Frank Perise, May, 1986.

DATA MAP OVERLAY: FISHHAB

013 SENSITIVE AREAS - FISH HABITATS - WORKSHOP MAP

Description: Sensitive areas for fish habitats in and around Presque Isle were identified on an 800 scale grid base map at the November 1988 Workshop by Roger Kenyon and Bob Wellington.

Data Items:	Federal Status	PA Status
0 = Null		
01 = Eastern Sand Darter	Review Candidate	Threatened
02 = Iowa Darter	None	None
03 = Lake Sturgeon (juvenile)	None	Endangered
04 = Spotted Gar, Bowfin	None	None

Information Source(s):

a. Sensitive Fish Habitats - Workshop Map, Roger Kenyon, PA Fish Commission and Bob Wellington, Biologist, Erie County Department of Health, November 1988.

DATA MAP OVERLAY: BIRDS

014 SELECTED BIRD SPECIES OF SPECIAL CONCERN MAP

Description: Selected bird habitats were identified (March/1986) on the DER Resource Management Plan base map (1"=800') by Jean Stull (Chairman Fish & Wildlife Task Force) and her assistants.

Because many breeding species move nesting, roosting, or feeding locations from year to year (within suitable Presque Isle habitats), only those species with very limited specialized habitats were mapped.

At least 10 species of special concern rely on wetland habitats, 21 species on woodland and/or edge habitats and 5 upon dead trees within or on the edges of woodland or wetland habitats. In addition, at least 17 species of special concern rely upon open sandy beach and/or open grassland habitats throughout Presque Isle.

NOTE: For information on other species of special concern see "Predominant Habitat. . .", Presque Isle Bird Species of Special Concern.

Data Items:	Federal Status	PA Status
0 = Null		
01 = Least and American Bitterns	None	Threatened
02 = Common Tern, Piping Plover	Listed Endangered	Extirpated
03 = Prothonotary Warbler	None	None
04 = Long-Eared Owl	None	None
05 = Black-Crowned Night Heron	None	None
06 = Sedge Wren	None	Threatened
07 = Least and American Bitterns, Marsh Wren and Black-Crowned Night Heron	None	Threatened
08 = Black Tern**	None	Threatened

Comments:

The following species are classified as threatened in Pennsylvania: American Bittern (Presque Isle Former Breeder, Migrant), Upland Sandpiper** (Presque Isle Migrant), Black Tern** (Presque Isle Breeder, Migrant), Sedge Wren** (Presque Isle Former Breeder, Migrant), Henslow's Sparrow** (Presque Isle Migrant).

The following species are classified as endangered in Pennsylvania: Bald Eagle (Presque Isle Former Breeder, Migrant), King Rail (Presque Isle Migrant), Peregrine Falcon** (Presque Isle Migrant), Osprey** (Presque Isle Migrant), Short-eared Owl** (Presque Isle Migrant) and Piping Plover** (Presque Isle Former Breeder, Migrant).

**Data provided by Jean Stull (comments postmarked November 25, 1988), must check PNDI database for location.

Information Source(s):

a. Jean Stull (Chairperson Fish and Wildlife Task Force), Sam Stull, Tim Kimmel, Jerry McWilliams. Date: 3/88, Scale: 1"=800'.

DATA MAP OVERLAY: **CMHAB**

015 CRITICAL MIGRANT BIRD HABITAT

Description: Critical Migrant Habitats were identified (March/1986) on the PA DER Resource Management Plan base map (1"-800') by Jean Stull and her assistants.

Data Items:

.0 = Null
.01 = Critical Migrant Habitat

Information Source(s):

a. Jean Stull, Chairperson Fish and Wildlife Task Force, Sam Stull, Tim Kimmel, Jerry McWilliams. Date: 3/88, Scale: 1"=800'.

b. Birds of Erie County Pennsylvania - Including Presque Isle, by Jean Stall, James A. Stull, Gerald M. McWilliams, Allegheny Press, 1985.

DATA MAP OVERLAY: **AMPHAB**

016 AMPHIBIAN AND REPTILE HABITATS

Description: A study conducted by Roger McPherson of the Biology Department of Clarion State College was an effort to compile a list of amphibian and reptile species present on Presque Isle State Park. Three techniques used included a survey of past literature, a collection of field data and an examination of the Carnegie Museum's (Pittsburg PA) collections and distribution record. The list of amphibia and reptile species of Presque Isle State Park that follows was the result of these efforts:

Data Items:	Federal Status	PA Status
0 = Null		
01 = Necturus m. maculosus - Mudpuppy	None	None
02 = Ambystoma maculatum - Spotted Salamander	None	None
03 = Notophthalmus v. viridescens - Red-Spotted Newt	None	None
04 = Bufo a. americanus - Eastern American Toad	None	None
05 = Bufo woodhousei fowleri - Fowler's Toad	None	None
06 = Hyla crucifer - Spring Peeper	None	None
07 = Hyla versicolor - Gray Treefrog	None	None
08 = Rana catesbeiana - Bull Frog	None	None
09 = Rana clamitans melanota - Green Frog	None	None
10 = Rana pipiens - Northern Leopard Frog	None	None
11 = Rana sylvatica - Wood Frog	None	None
12 = Chelydra s. serpentina - Common Snapping Turtle	None	None
13 = Sternotherus odoratus - Stinkpot	None	None
14 = Clemmys guttata - Spotted Turtle	None	None
15 = Clemmys insculpta - Wood Turtle	None	None
16 = Terrapene c. carolina - Eastern Box Turtle	None	None
17 = Graptemys geographica - Map Turtle	None	None
18 - Chrysemys picta marginata - Midland Painted Turtle	None	None
19 = Trionyx s. spiniferous - Eastern Spiny Softshell	None	None
20 = Heterodon platyrhinos - Eastern Hognose Snake	None	Tentatively Undetermined
21 = Lampropeltis t. triangulum - Eastern Milk Snake	None	None
22 = Nerodia s. sipedon - Northern Water Snake	None	None
23 = Regina septemvittata - Queen Snake	None	None
24 = Storeria d. dekayi - Northern Brown Snake	None	None
25 = Thamnophis brachystoma - Shortheaded Garter Snake	None	None
26 = Thamnophis sauritus - Eastern Ribbon Snake	None	None
27 = Thamnophis s. sirtalis - Eastern Garter Snake	None	None
28 = Emydoidea blandingi - Blandings Turtle	None	Endangered

Comments: Only two species have been mapped: item #20 and #28. Item #28 was added to the McPherson list at the workshop conducted during the ESA study. Upon available information, those species classified as species of special concern may ultimately be mapped.

Source: "Amphibians and Reptiles of Presque Isle State Park, Erie, PA", Roger McPherson, Biology Department, Clarion State College, no date cited.

The mapping is based on workshop maps. Toby Cunningham identified an area where he recalled that the Blandings Turtle was sighted, and identified an area of suitable habitat for this species. Also, locations for Blandings Turtle and the Eastern Hognose Snake were identified by Dan McKinsky on a separate workshop map.

DATA MAP OVERLAY: **INVHAB**

017 INVERTIBRATE HABITATS

Description: Naiad mollusks considered to be rare/endangered (Heptodea fragilis, Fragile Paper-Shell; Ligumia masuta, Eastern Pond-Mussel; Potamilus alatus, Pink Head-Splitter; Quadraila quadrula, Maple-leaf) by the Western Pennsylvania Conservancy were surveyed in the locations identified below, although it is believed that these populations extend to other portions of these water bodies. These species might be expected in any relatively undisturbed sand/gravel substrate in waters approximately one half to three plus meters in depth in Presque Isle or other bays sharing water with Presque Isle Bay or Lake Erie.

The geometrid moths may be expected to occur widely across Presque Isle, however the location mapped below highlights a specific sighting and food plant group most likely associated with larvel stage of development.

The following communities were mapped.

Data Items:

0 = Null
01 = Rare Naid Mollusk Beds (known locations)
02 = Geometrid Moth Habitat

Information Source(s):

a. Memorandum, Charles W. Bier, Plant/Animal Ecologist, PA Natural Diversity Inventory, Western PA Conservancy, 1989.

b. Personal Communication, Clark Shiffer, Pennsylvania Fish Commission, 1989.

DATA MAP OVERLAY: **NWIWET**

018 WETLANDS/DEEPWATER HABITATS

Description: Wetlands which naturally purify surface and groundwater, provide flood and storm damage protection, prevent soil erosion, provide essential habitats for fish and wildlife and maintain critical base flow to surface waters, are a vital resource of Presque Isle's environment. The wetlands of Presque Isle comprise some of the most extensive wetlands in Pennsylvania.

Data Items:

0 = Null
01 = PUBH - Palustrine unconsolidated bottom - permanent
02 = PUBBH - Palustrine unconsolidated bottom - saturated permanent
03 = PUBHX - Palustrine unconsolidated bottom - permanent excavated
04 = PUSC - Palustrine unconsolidated bottom - seasonal
05 = PSSIE - Palustrine scrub/shrub broad-leaved deciduous seasonal saturated
06 = PAB4 - Plustrine aquatic bed floating-leaved
07 = PAB4G - Palustrine aquatic bed floating-leaved - intermittently exposed
08 = PEM1F - Palustrine emergent - persistent semipermanent
09 = PEM5C - Palustrine emergent - narrow-leaved persistent - seasonal
10 = PEM5E - Palustrine emergent - narrow-leaved persistent - saturated
11 = PEM5F - Palustrine emergent - narrow-leaved persistent - saturated
12 = PSSI, PAB4F - Palustrine scrub/shrub broad-leaved deciduous and palustrine aquatic bed floating-leaved semipermanent
13 = PSS1E, PEM5E - Palustrine scrub/shrub broad-leaved deciduous - seasonal saturated and palustrine emergent narrow leaved persistent seasonal satured
14 = PSS1E, PEM5F - Palustrine scrub/shrub broad-leaved deciduous - seasonal saturated and palustrine emergent narrow leaved persistent seasonal satured
15 = PFO1C - Palustrine forested broad-leaved deciduous - seasonal
16 = PFO1E - Palustrine forested broad-leaved deciduous - saturated
17 = L2U5A - Lacustrine-littoral - unknown - temporary tidal - tempoary
18 = L2U5C - Lacustrine-littoral - unknown - temporary tidal - seasonal
19 = L2AB46 - Lacuistrine-littoral - acquatic bed - floating-leaved - intermittently exposed
20 = PF01, PEM5E -

Information Source(s):

a. U.S. Fish and Wildlife National Wetland Inventory. Date: 1986, Scale: 1:24,000.

DATA MAP OVERLAY: **LANDFORM**

019 GEOLOGICAL FEATURES

Description: Presque Isle Peninsula is a recurving sandspit in which eroded sand from the western end is deposited at the eastern end.

Shoreline dynamics were described in the Presque Isle State Park Resource Management Plan (1986) as follows:

> Shoreline stability in any unprotected natural coastal zone is controlled by the supply, transfer, and loss of material (McGill, 1980). Sand accumulation (or loss) at any point on the shore is equal to the amount of sand coming into the system minus the amount lost downshore and/or lost offshore. Presque Isle persists because the incoming supply of sand is more or less equal to the amount being lost to other parts of the system.
>
> Rather than being stable for any length of time, the beach is in a process of dynamic equilibrium through time unless the natural processes are thrown out of balance by a drastic change in the amount of beach material, changes in lake level, by storm waves in a 50-10 year event, or various other factors. The supply of sand to the system originates updrift. The sources are streams carrying sediment to the littoral and/or material wasted from the shoreline itself including the sand content of the bluff.
>
> A beach may be temporarily eroded by storm waves and then restored by the milder constructional wave. In addition, the erosion and accretion patterns may occur seasonally. The long-term configuration of the beach is totally dependent on supply. For example, the shore will accrete sand and will prograde when the rate of supply of sand exceeds the rate of loss.

Data Items:

0 = Null
01 = Old Dunes (relic features)
02 = Newly Forming Dunes
03 = Natural Shoreline (no rip-rap)
04 = Transportation Environment
05 = Depositional Environments

Information Source(s):

a. Paul Knuth, Edinboro State College, Geologically Significant Areas Workshop Map, November 1988.

b. Interview, Dr. David Thomas, , October 1988.

DATA MAP OVERLAY: **AUDUBON**

020 SIGNIFICANT NATURAL AREAS

Description: The protection of significant natural areas on Presque Isle Peninsula was presented as a policy proposal to PADER for consideration in formulating the Presque Isle Natural Resources Management Plan by the Presque Isle Chapter of the National Audubon Society. In addition to an "Ecological Reservation" and a "Sanctuary," six "Satellite Areas of Concern" were noted.

Data Items:

0 = Null
01 = Gull Point Sanctuary
02 = Ecological Reservation
03 = Satellite Area I
04 = Satellite Area II
05 = Satellite Area III
06 = Satellite Area IV
07 = Satellite Area V
08 = Satellite Area VI

Information Source(s):

a. Personal Communication Jean Stull, October 1988.

b. A Policy Proposal submitted to the Pennsylvania Department of Environmental Resources, for consideration in formulating the Presque Isle Natural Resources Management Plan, regarding the protection of significant natural area and Presque Isle Peninsula, Erie County, PA submitted by the Presque Isle Chapter of the National Audubon Society/January 1986.

DATA MAP OVERLAY: **HIGHQUAL**

021 HIGH QUALITY AREAS - WORKSHOP MAP

Description: High Quality areas were identified on an 800 scale grid base map by Jim Bissel, Jean Stull and Bob Wellington at the November 1988 Workshop Meeting. High Quality Areas is a joint cognitive map formed as collective subjective judgement of the above individuals.

Data Items:

0 = Null
01 = Best
02 = Lesser
03 = Even Lesser

Information Source(s):

a. High Quality Areas Workshop Map, Jim Bissell (Curator of Botany, Cleveland Museum of Natural History), Jean Stull (Presque Isle Advisory Committee) and Bob Wellington (Erie County Department of Health), November 1988.

SOILS

DATA MAP OVERLAY: **SOILS**

022 PA DER RESOURCE MANAGEMENT PLAN SOILS MAP

Description: The following soil types were documented at Presque Isle State Park in a soil survey conducted for the Presque Isle Resource Management Plan (PA DER, 1986). Soil types were mapped and described as follows:

> The four soil types which occur in the park are all "new" soils which are currently in the process of formation and change. Caution needs to be exercised due to their fragility and in selecting species to be planted due to the lack of soil nutrients and drought-prone characteristics of these soils.
>
> BEACH AND RIVERWASH (Ba) - This miscellaneous land type is made up of unassorted sand, gravel, and small fragments of flagstone. Before sediments are deposited on the beach, they are transported by streams and are then dropped into the waters of the lake. Here, they are reworked by wave action and are then washed onto the beach. During storms the beach material is again reworked and is carried eastward by shore currents. In its place new sediments are deposited by waves. During the winter a well-defined beach is often altered greatly by storms. Beach and riverwash is not stable enough to maintain a cover of plants. It consists largely of material weathered from the underlying shale; it also includes some sediments of sandstone, granite, and quartzite that were carried into the area by glaciers. No soil profile has developed. This land type has no value for agriculture, but it provides valuable areas for recreation.
>
> BEACH SAND, STABILIZED (Bb) - This miscellaneous land type consists of deep, sandy beach material that is nearly level and moderately well-drained to poorly drained. This material is mostly acidic with the exception of the moist sandplains at Budney Beach which has alkaline characteristics. It is protected by a beach ridge from the waves of Lake Erie. The material has been in place long enough so that it has a cover of plants but not long enough for a soil profile to form. It does, however, have an organic surface layer. No erosion has taken place. This extensive land type occurs only on Presque Isle. The vegetation consists primarily of cottonwood, bayberry, and several important grasses - Indiangrass, switchgrass, and little bluestem. The seeds of these grasses apparently were brought to Presque isle by the lake current. This miscellaneous land type formerly consisted of shifting sand. The sand became stabilized after a ridge was built up that protected it from wave action. The beach sand is only 1 to 1 1/2 feet above the level of the lake. The permanent water table, therefore, is only about that depth below the surface. The beach sand is low in plant nutrients but the groundwater has minerals and nitrogen in solution. These plant nutrients, along with the favorable permeability of the material and the stable supply of moisture, cause plants to make a dense growth. This land type has little agricultural value. It is suitable for recreational use and is also suitable for trees or for wildlife habitats.

SOILS - continued

022 PA DER RESOURCE MANGEMENT PLAN SOILS MAP - continued

DUNE SAND (Ds) - This miscellaneous land type consists of deep, loose, droughty, windblown sands. The sands were sorted from the lacustrine materials by wind and were blown into the shape of dunes. These dunes were built primarily by beach grass and switch grass. The dunes lack the characteristic crescent or oblong shape of active dunes because they have been partially stabilized by little bluestem, switchgrass, and cinquefoil.

FRESH WATER MARSH (Fm) - This miscellaneous land type occurs in shallow lagoons on the bay side of Presque Isle. The soil material consists of 6 to 12 inches of partly decomposed organic material that is underlain by deep lacustrine sand and gravel. The surface is covered by 1 to 3 feet of water. The water level fluctuates seasonally and is especially high following storms. The areas support a luxuriant growth of sedges and are suitable as habitats for wildlife. In general, most of the Presque Isle marshes are sedge marshes, and the sedge marshes support many Plants of Special Concern. The growth of cattails in many of the marshes is associated with disturbance and the cattail growth may well be a long term threat to the sedge marshes in the park.

Data Items:

01 = Beach and Riverwash - Ba
02 = Beach Sand, Stabilized - Bb
03 = Dune Sand - Ds
04 = Fresh Water Marsh - Fm

Information Source(s):

a. PA DER Presque Isle Resource Management Plan Soils Map. Date: 1986, Scale: 1" = 800'. This mapping was derived from the Soil and Water Conservation Plan, Presque Isle State Park #352, Millcreek Township Soil Conservation Service, scale: 1" = 660', 1986.

DATA MAP OVERLAY: **VEGCOVER**

023 PA DER RESOURCE MANAGEMENT PLAN VEGETATION MAP

Description: In 1985, forest types on Presque Isle were mapped by the Pennsylvania Bureau of Forestry and the Pennsylvania Bureau of State Parks. All park land stands were classified using a three-digit system (PA Bureau of Forestry, 1985) to represent forest type, site and size, and stocking class.

CODE

FOREST TYPE (Based on the trees that make up the main canopy of the stand)

A	**Mixed Oak**	Principally oak in various mixtures in stands whose composition is such that they do not qualify for any of the other type descriptions.
B	**Northern Hardwood**	Sugar maple, beech and yellow birch 50 percent or more. (Percentages refer to the total cubic foot volume per acre). Usually in various mixtures; occasionally pure. Red maple, hemlock, red oak, white ash, black cherry, white pine, tulip tree, black birch and white birch are associates.
D	**Aspen-Gray Birch**	Pioneer species including aspen, gray birch and red maple in mixture - sometimes pure.
P	**Plantations**	One acre and larger in manageable condition and identifiable as plantations. Plantings presently more than 50 percent hardwood, overtopped by hardwoods, or less than one acre in size will be considered part of the surrounding natural stands. Pure stands of natural Virginia pine or other conifers which meet the above requirements will be coded and inventoried as plantations.

VEGCOVER - continued

023 PA DER RESOURCE MANAGEMENT PLAN VEGETATION MAP - continued

SITE CLASS

1	Site I	Dominant and co-dominant trees reach three or more 16-foot logs at maturity. White pine and hemlock should produce 3 1/2 or more 16-foot logs. Characterized by moist, well-drained, fairly deep soils which usually occur in protected coves, along strams, or in bottomlands that remain moist throughout the year. On northern exposures, Site I may extend higher up a slope than on southern exposures because of more favorable soil moisture conditions. In addition to the usual beech-birch-maple-cherry of northern hardwoods, white pine, hemlock, ash and basswood are generally present. In the oak types where red oak and white oak, with hemlock, form the major portion of the stand, the presence of yellow poplar and ash indicates Site I.
2	Site II	Dominant and co-dominant trees reach two to 2 1/2, 16-foot logs at maturity. White pine and hemlock should produce 2 1/2 to three 16-foot logs. Characterized by soils intermediate in moisture, depth, drainage and fertility and which dry out for only short periods during the year. Usually located on slopes between the ridge tops and the coves and bottomlands. In the northern hardwood type, Site II is primarily a beech-birch-maple mixture with shorter heights than on Site I. In the oak types, Site II has a preponderance of red oak, black oak, white oak and, to a lesser extent, scarlet oak and chestnut oak.
3	Site III	Dominant and co-dominant trees less than two 16-foot logs at maturity. Pitch pine and white pine may yield two 16-foot logs. Characterized by the shallow, rather dry, stony or compact soils which usually occur on ridges or broad, flat plateaus.

VEGCOVER - continued

023 PA DER RESOURCE MANAGEMENT PLAN VEGETATION MAP - continued

SIZE/STOCK CLASS

1 Majority of the dominant and co-dominant trees are 14" Dbh, and over with more than 60 sq. ft. basal area in the stand.

2 Majority of the dominant and co-dominant trees are 8" to 14" Dbh, and over 50 sq. ft. of basal area in the stand.

3 Majority of the dominant and co-dominant trees are 4" to 8" Dbh, and over 50 sq. ft. of basal area in the stand.

Data Items:

0 = Null
01 = A11 Mixed Oak, Site 1, Size/Stock 1
02 = B11 Northern Hardwood, Site 1, Size/Stock 1
03 = B22 Northern Hardwood, Site 2, Size/Stock 2
04 = D11 Aspen-Gray Birch, Site 1, Size/Stock 1
05 = D12 Aspen-Gray Birch, Site 1, Size/Stock 2
06 = D22 Aspen-Gray Birch, Site 2, Size/Stock 2
07 = D23 Aspen-Gray Birch, Site 2, Size/Stock 3
08 = P Plantations
09 = 03 Upland open area, old field or upland meadow, natural herbaceous vegetation.
10 = 04 Upland open area, savannah (grass, fern, sweet fern)
11 = U1 Wetland (1-acre and larger) - wooded swamp, dead or live tree-dominated (50 percent or more of site) wetlands which are saturated to the surface or flooded with water
12 = U2 Wetland (1-acre and larger) - shrub swamp, shrub-dominated (50 percent or more of site) wetlands which are saturated to the surface or flooded with water
13 = U4 Wetland (1-acre and larger) - marsh and wet meadow, characterized by emergent herbaceous vegetation (cattails, sedges, rushes, etc.) and saturated to the surface or flooded with water

Information Source(s):

a. PA Bureau of Forestry 1985 Study, G. Volgstasdt Study. Date: 1985, Scale: 1" = 800'.

DATA MAP OVERLAY: **ALIENS**

024 ALIEN SPECIES OF VEGETATION

Description: The uncontrolled spread of several plant species poses a threat to the long-term survival of plants native to Presque Isle. The 1987 Presque Isle State Park Botonical Survey and Natural Communities Classification Study (Cleveland Museum of Natural History, Western PA Conservancy, Dec. 1987) stated the following:

> Phragmites (Phragmites australis) and hybrid cattail (Typha X glauca), pose a serious threat to the long term survival of several rare wetland communities within the park. The phragmites growing within Dead Pond is currently competing with several plants which are endangered, threatened or rare in PA: four-angled spike-rush (Eleocharis quadrangulata); hard stem bull-rush (Scirpus acutus); water sedge (Carex aquatilis); and twig-rush (Cladium mariscoides). Dead pond is the only location where twig-rush currently grows in the park. There are only 21 twig-rush plants and a dense stand of phragmites now grows above the twig-rush. A research program should be initiated to determine if treatment of the aerial portions of phragmites with the herbicide Rodeo favors the growth of Cladium within the phragmites stand.

The list of alien plants at Presque Isle includes, but is not limited to the following species.

Data Items:

0 = Null
01 = Typh x glauca - Hybrid cattail*
02 = Phragmites australis - Phragmites*

* These areas were estimated by James Bissell and Charles Bier (Sept, 1988) based upon on-site field observations and knowledge of previous habitats.

Data Void: Future identification by researchers will identify locations of the following alien species:

Lonicera morrowi - Japanese bush-honeysuckle
Polygonum cuspidatum - Japanese knotweed
Typha angustifolia - Narrow leaved cattail
Clastrus orbiculatus - Chinese bittersweet
Alnus glutinosa - European alder

Information Source(s):

a. Personal Communication, James K. Bissell, Curator of Botany, Cleveland Museum of Natural History, Sept. 1988.

b. Personal Communication, Charles W. Bier, Plant/Animal Ecologist, Western PA Conservancy, Sept. 1988.

SCIENTIFIC RESEARCH

DATA MAP OVERLAY: **RESEARCH**

025 WATER QUALITY MONITORING STATIONS

Description: Water quality monitoring is probably the most extensive monitoring program at Presque Isle. Three water quality stations (EPA STORET NETWORK) are located in waters surrounding the park, lifeguards sample and test bathing beach waters (twice weekly) during the beach season and the Erie County Department of Health also conducts a monitoring program. Although water quality surrounding the park is monitored, interior ponds and waterways are not monitored regularly.

RESEARCH AREAS - WORKSHOP MAP

Description: Scientific research areas were identified on an 800 scale grid base map at the November 1988 Workshop by Obie Derr, Jean Stull, Toby Cunningham, and Charles Bier. Bird banding stations, operated by the U.S. Fish and Wildlife Service in addition to vegetation research areas were mapped.

BAT HOUSES/RESEARCH AREAS

Description: Bat houses and research areas were located on a Presque Isle brochure map by Dr. Ken Anderson, researcher of bats at Presque Isle.

Data Items:

0 = Null
01 = Bird Banding Stations
02 = Herpetology Study Sites
03 = Bat Houses & Study Areas
04 = Water Quality Monitoring Stations

Information Source(s):

a. Erie County Department of Health provided latitude/longitude points locating water quality monitoring stations.

b. Research Areas - Workshop Map, Obie Derr (PA DER), Jean Stull (U.S. Fish and Wildlife Bird Bander), Toby Cunningham (Biologist, Penn State University), and Charles Bier (Animal ecologist PA Western Conservancy).

c. Personal Communication: Dr. Ken Anderson, Biologist, Gannon University, 1988.

PHYSICAL FEATURES

DATA MAP OVERLAY: **ROADS**

026 TRANSPORTATION ROUTES

Description: Roadways, trails and parking areas designated on the PA DER Resource Management Plan base map (800 scale) were mapped.

Data Items:

0 = Null
01 = Peninusla Drive
02 = Marina Drive
03 = East Fisher Drive
04 = Thompson Drive
05 = Pine Tree Road
06 = Old Peninsula Road
07 = West Fisher Road
08 = Coast Guard Road
09 = Access Roads
10 = Secondary Roads (Not Paved)
11 = Hiking Trails
12 = Parking Areas

Comments: Several hiking trails are shown in the Presque Isle Park Recreation Guide, however, only two trails, Sidewalk Trail and Dead Pond Trail were shown on the base map. In addition, parking areas, including Vista Parking, Life Guard Headquarters, Beach 9 and Marina Lots were also not shown on the base map.

Information Source(s):

a. Presque Isle State Park Resource Management Plan Base Map, PA DER. Date: 1986, Scale: 1"=800'.

DATA MAP OVERLAY: **HISTORIC**

027 HISTORIC/STRUCTURES/SITES

Description: A total of 30 buildings/structures/sites having historic significance listed by the Pennsylvania Historical and Museum Commission's Historic Resource Survey are located in Presque Isle State Park.

Data Items:

0 = Null
01 = Fog Signal Station, ca. 1899. Archaeological
02 = Single Dwelling, ca. 1870. Lighthouse Establishment
03 = Double Dwelling, ca. 1900. Lighthouse Establishment
04 = Pierhead Light, ca. 1819. Lighthouse Establishment
05 = Leo's Boat Livery
06 = "French Stone Chimney," ca. 1753. Archaeological
07 = British Post, 1760. Archaeolgical
08 = Crystal Point Blockhouse, 1813. Archaeological
09 = French Blockhouse, ca. 1758. Archaeological
10 = Caviar Factory, ca. 1922. Archaeological
11 = Fire Tower, ca. 1922. Archaeological
12 = Biological Field Laboratory, ca. 1930. Archaeological
13 = "Waterworks" Sawmill, ca. 1921. Archaeological
14 = Thompson Monument, ca. 1931. Park and Harbor Commission
15 = Misery Bay, ca. 1753-1945. Archaeological
16 = Nature Center, "English Cottage" style, ca. 1935
17 = Pumphouse, ca. 1925
18 = Smokehouse Pavillion, ca. 1920
19 = Superintendent's Residence, former summer house, ca. 1903
20 = Presque Isle Lighthouse, ca. 1872
21 = Miscellaneous park building, ca. 1930
22 = Miscellaneous park building, ca. 1930
23 = Miscellaneous park building, ca. 1930
24 = Miscellaneous park building, ca. 1930
25 = Miscellaneous park building, ca. 1930
26 = Miscellaneous park building, ca. 1930
27 = Miscellaneous park building, ca. 1930
28 = Miscellaneous park building, ca. 1930
29 = Miscellaneous park building, ca. 1930
30 = Perry Monument, ca. 1926

Information Source(s):

a. Pennsylvania Historical and Museum Commission's Historic Resource Survey (1986) PA DER Resource Management Plan.

BASE MAPS

DATA MAP OVERLAY: **PLANBASE**

028 PA DER RESOURCE MANAGEMENT PLAN BASE MAP

Description: The 1" = 800' scale base map provided in the Presque Isle Resource Management Plan, 1986.

The Resource Management Plan Base Map was updated, viz. Gull Point area, using the digital base prepared by the U.S. Fish and Wildlife Service based on 1986 aerial photography. Map to grouond referencing is based on PA Coordinate System, North Zone (State Plane).

Data Items:

0 = Null
01 = Presque Isle land base
02 = 500' off-shore boundary
03 = City of Erie
04 = Lake Erie
05 = Presque Isle Bay & Misery Bay

Information Source(s):

a. Presque Isle State Park Resource Management Plan Base Map, PA DER. Date: 1986, Scale: 800' (based on USGS 7½" quandrangle 1972).

b. Digital Base Information, U.S. Fish and Wildlife Service, 1986 aerial information.

DATA MAP OVERLAY: **BYTH**

029 NOAA MAP

Description: National Oceanic and Atmospheric Administration survey map.

Wave action and nearshore circulation in correlation with water depth (bathymetry - offshore topography) was described in the Presque Isle Park Resource Management Plan (PA-DER, 1986) as follows:

> In deep water, waves cannot cause erosion because the motion of the wave cannot reach bottom. In shallow water, waves not only touch bottom, they exert considerable force against it, increasing as the wave nears shore. Along coasts comprised of loose materials (unconsolidated sediment), such as sands and silts, large quantities of particles are churned up especially as the waves break near shore.
>
> The water depth at which waves begin to move bottom particles is called wave base. This depth increased with wave size and is proportional to 1.0 times to 2.0 times the wave height. In Lake Erie wave based averages around three meters.
>
> The bathymetry offshore governs the point at which wave base makes contact with the bottom. Gentle waves with a base of less than three feet move sediment shoreward. A slightly higher wave producing a deeper wave base breaks shoreward moving sand offshore depositing the sediment in a bar form.

Offshore topography (depths in feet) was obtained from the National Oceanic and Atmospheric Administration (NOAA) Erie Harbor color map. Depths for Long Pond, Big Pond, and Horse Shoe Pond were also included. Depths for interior ponds were not determined but estimated (by NOAA) at seven feet or less.

Data Items:

0 = Null
01 = less than one foot - Green zone
02 = 1.0 foot to 7.0 feet - Deep blue zone
03 = 7.0 feet to 12.0 feet - Light blue zone
04 = 12.1 feet to 18.0 feet - Light blue zone
05 = 18.1 feet to 24.0 feet - Light blue zone
06 = 24.1 feet to 30.0 feet - Light blue zone
07 = 30.1 feet and greater - White zone

Information Source(s):

U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Survey. Erie Harbor. Date: July/80, Scale: 1" = 1250'.

APPENDIX B

THE MAP ANALYSIS PACKAGE (MAP)

OVERVIEW

List of Commands In the OSU MAP-for-the-PC

ADD: THIS COMMAND CREATES A NEW MAP BY ADDING TWO OR MORE INPUT MAPS. THE ADDITION IS DONE ON A CELL BY CELL BASIS.

AVERAGE: THIS COMMAND CREATES A NEW MAP BY AVERAGING TWO OR MORE INPUT MAPS. THE AVERAGE IS DONE ON A CELL BY CELL BASIS USING INTEGER DIVISION.

CLUMP : Creates a map by identifying contiguous groups of cells with the same value within a given search radius. Each clump is assignied a new unique sequential value.

COLOR : Displays a map assigning a unique color to each map value in the range of the display device. The IBM EGA is capable of coloring values 0 to 15. On a monochrome screen, it will just be black and white.

CONTOUR : Displays a coverage by threading isolines through a grid of map values.

COPY : Creates a map by reproducing an input map.

COVER : Creates a map by overwriting the values of the first input map with the non-zero values of one or more other input maps. Each successive input map covers the result of the previous cover.

CROSS : Creates a map by pairing values from two input maps. New values are assigned to a pair on a cell-by-cell basis. Use / to continue command on next line.

DESCRIBE : THIS COMMAND PRODUCES A TABULAR LISTING OF THE INPUT MAP. IT CONTAINS :

Name
Scale
Protection Status
Value
Labels
Cells/Value

DIFFERENTIATE : Differentiate creates a map of slope values. The default mode fits a plane to the eight immediate neighbors. Maximally selects the greatest slope from the target cell to any of the eight immediate neighbors.

DIVIDE : Creates a map by dividing the cell values of the first input map by the cell values of successive input maps. Each successive input map divides the result of the previous divide.

DRAIN : Outputs a map which identifies cells along the steepest downhill path from a map of start cells along a second surface map.

DUMP : Writes the values of a map overlay to a user specified DOS

file. The values are written in ASCII format to allow easy editing.

ECHO : Sets message reporting on or off for descriptive massages that are issued during program opperation.

EULER : Euler measures an areas solidness. The assigned value is computed as the number of wholly enclosed islands minus the of islands which make up the area minus 1

EXPLAIN : Explain produces a short verbal and syntactic description of a specified map command.

EXPONENTIATE : Creates an map by raising the values of the first input map to the powers of successive input maps on a cell-by-cell basis. Each successive input map powers the result from the previous exponentiate.

EXPOSE : Sets the protection status associated with an existing map such that the map is no longer protected from being modified.

FILTER : Creates a new map by applying a 3x3 filter. Several edge enhancemnet and smoothing filter are built in. The users can also specify their own filter mask.

FIND : Find allows the interactive examination of a map layer. A cross hair cursor is displayed on top of a map layer and row, column and value of that cell is displayed. The cursor may be moved using the cursor keys. Optionally the command allows creating a new map layer with selected cells from an existing map layer. Use the arrow keys to move around, INS key to save current value to the <outmap> and the END key to exit the command.

GRID : Grid creates a map by assigning new values to the individual cells of an input map on a row-by-row basis.

INFORM : Inform reports the values of certain program parameters.

LABEL : Label assigns labels to the values of an existing map. Labels have a maximum length of 16 characters. Labels for values upto of 99 can be assigned.

LIST : Lists the coverage files in the database by: name, database location and protection status.

MAP : Map creates a new map by assigning a single value to all the map cells.

MAXIMIZE : Maximize creates an output map by conparing two or more maps and retains whichever value is greatest on a cell by cell basis.

MINIMIZE : Minimize creates an output map by conparing two or more maps and retains whichever value is smallest on a cell

by-cell-basis.

MULTIPLY : Multiply creates a new coverage by multiplying the values of two or more maps on a cell-by-cell basis.

ORIENT : Orient creates a map of azimuthal direction. On output values range either from 1 to 9:

1=north, 2=northeast
3=east, 4=southeast
5=south, 6=southwest
7=west, 8=northwest
9=horizontal surfac

or precisely from
1 through 361:
90 =east, 180=south
270=west, 360=north
361=horizontal surf

PALETTE : Allows the user to switch between several predetermined color combinations by specifing the desired palette number. It also allows the user to import palettes from a color or palette file created by the pallete program.

1= distinct colors (0 to 15)
2= cartographic elevation colors (0 to 7)
3= hue gradations (0 to 15)

PAUSE : Allows the user to insert a pause between commands. This is especially usefull when putting together a slide show. The pause command can either be used to pause for a certain number of seconds or until a key is pressed.

PLPMAP : Creates a map by converting point, line, and polygonal data into the grid form used by the Map Analysis Package. Input must be a DOS file in SAS format.

POINT : Creates a map by assigning new values to the individual cells of an input map. An individual cell is referenced by its column and row location.

PROFILE : Profile assigns to each output cell the vertical angle formed with the cell and two neighboring cells. Default output is sideslope aspects from 1 to 9. Inflection output gives skyward angle in degrees.

PROTECT : Sets the protection status associated with an existing map such that the map is protected from being modified.

EXAMPLE : PROTECT GOODMAP

RADIATE : Creates a map assigning a value for each cell according to the visibility of that cell from one or more viewer cells defined on an input map.

READ : Provides for reading of commands from the keyboard or a previously prepared DOS file. Currently the DOS file name must not exceed 8 characters long.

RENUMBER : Creates a new map by replacing inmap values with new values.

RESPACE : Respace dispays a portion of a map on the screen. It fits the map subset into the screen by expanding it. It is analogous to a zoom command.

SCALE : Assigns a geographic scale to an existing map.

SCAN : Computes a new value for each scanning cell

SCORE : Compares the values of one input map with those of another input map on a cell-by-cell basis.

DRAPE : Displays an overlay as a prospective profile. The profiles can be colored by specifying a second overlay.

SIZE : Assigns new values to the old values of an input map according to the size of the area associated with the value.

SLICE : Divides the range of input map values into equal intervals and renumbers the values ordinally. Empty intervals are not reported.

SORT : Creates a map values from lowest to highest. The new map will contain a number corresponding to the position of the original number in inmap>

SPAN : Assigns values for seed points indicating the narrowness of an area surrounding the seed points.

SPREAD : Assigns cell values according to the length of the shortest path between that cell and a target area.

STOP : Stop terminates the map program!

STRIP : Assigns new values to horizontal runs of cells. Start and stop position is specified by column number. All numbers must occupy 3 spaces.

SURFACE : Produces a 3-Dimensional fishnet drawing.

SUBTRACT : Creates an output map by subtracting the values of one or more input maps from the first input map on a cell-by-cell basis.

SURVEY : Creates a map by assigning new values to the categories of the input map. The new values provide a quantitative measure of shape. Input values must be within the range 1 to 499. Output values will range from 1 to 100.

TRACE : Assigns values to the map cells which lie along a user specified line segment. A line is defined by the x,y coordinates of its endpoints.

WRITE : Allows the user specify where output is displayed Output can either be written to the screen, a DOS file or a printer. Currently the DOS file name must not exceed 8 characters in total length.

ZAP : Erases the name of an existing map from the map database.

APPENDIX C

LIST OF INFORMATION

COLLECTED

PRESQUE ISLAND STATE PARK
ENVIRONMENTAL SENSITIVE AREA ANALYSIS

INFORMATION COLLECTED
(to be continually updated)

TOPIC		TITLE/FORMAT	SOURCE
1. Bathymetry	A.	Erie Harbor - Soundings in Feet Color Plan Sheet Scale 1=15,000 1"=1,250' July/80	N.O.A.A.
2. Birds	A.	- "Finding Birds on Presque Isle" 1965 --> has been SS latest guide to be received	Jean Stull
	B.	- Proposal from P.I. Audubon Society, 1986 - Policy proposal --> Protection of Natural Areas --> Map to Follow	Audubon Society
	C.	- "Piping Plover," Article by Susan Haig	Natural Areas Journal
	D.	- P.I. Bird Species of Special Concern, 1986 List w/status and habitat	
	E.	- Jean Stull's Comments: Base Map 1"=800' 8 1/2 x 11" Map 1"=2,000', Migrating Areas	
	F.	- Selected Bird Species of Special Concern Base Map 1"=800'	Fish & Wildlife Task Force: Jean Stull CHM Sam Stull Tim Kimmel Jerry McWilliams
	G.	- Duck Blind Locations 8/87 1"=1,000'	Northwestern PA Duck Hunters Association
	H.	- Duck Hunters' Code of Ethics Permit info concerning Presque Isle Duck hunting	DER, Erie Sportsman Clubs

	I.	- "Birds of Erie County Including Presque Isle"	1985 Jean Stull, James A. Stull, Gerald M. McWilliams
	J.	- Data Collection Inteview with Jean Stull, P.I. Chapter National Audubon Society	
3. **Ecology**	A.	- Classification of Wetlands and Deepwater Habitats of the U.S. Dec./1979	Fish & Wildlife U.S. Dept. of Interior Biological Service Prgm
	B.	- "Comparative Ecology of Sandspit Ponds"	Edward J. Kormondy The American Midland Naturalist Univ. of Notre Dame Press
	C.	- "The P.I. East Access Bridge: An Ecological Survey" date? Includes Maps of P.I.: 1818, 1837, 66 1903, 1970, 1971 Photo Log	Stanley J. Zagorski Gannon University
	D.	- "A field study of the Bioloical Resources of the Gull Point Area of Presque Isle State Park," 1978	Robert Klips Corps of Engineers Buffalo District
	E.	- Wetlands of the United States: Current Status and Recent Trends March, 1984	Fish & Wildlife Service U.S. Dept. of Interior
	F.	- National Wetland Inventory Map Erie North Pa, quad Scale 1:2400, 1975	Fish & Wildlife Service U.S. Dept. of Interior
4. **Vegetation**	A.	- Resource Mgmt Plan - Veg Map 1"=800' Vegetation Cover Type Classification	PA DER, B of Forestry
	B.	- Botanical Survey & Natural Community Classification, Dec. 87 Species location on 8½x11 sheets Natural Communities Map 1"=400', 1:7477	Cleveland Museum of Natural History Western PA Conservancy Jim Bissell

	C.	- Selected Species of Special Concern 1"=800' Colored Base Map, 1986	Jim Bissell Curator of Botany Ted Grisez - Botanist Evelyn Anderson - CH Veg. Task Force Jean Stull
	D.	- "Key to Map," Locations of Hairy Puccoon correspondance - Bissell --> Donn (Zurn Industries) --> Deer Problem, Rare Plants, Protection Area	Jim Bissell
	E.	- Article: Summary of 4 Stewardship Suggstions Oct./87 - Phragmites, Typhaxglauca, deer	Jim Bissell
	F.	- 1985 Rare Plant Occurrences 8 1/2x11 sheets - locations noted Rare Plant Trail Flats - where land use should be maintained	Jim Bissell
	G.	- 1986 Rare Plant Survey 8 1/2x11 sheets - locations noted	Jim Bissell
	H.	- Annex A, DER, Protection of Natural Resources --> Chapter 82 Conservation of PA Native Wild Plants - - Became LAW January 1988	DER
	I.	Plant Species of Special Concern in Pennsylvania - Global rank, state, federal and state-status definitions and lists plant species of special concern with status	Pennsylvania Natural Diversity Inventory
	J.	- Data Collection interview with Jim Bissel, Charles Bier, Beverly Davidson	September 1988
	K.	- 100 Year Comparative Study of the Orchidaceae and Ericaceae on Presque Isle, 1980	Steve Waisiesky Edinboro State College
5. Geology	A.	52nd Annual Field Conference of PA Geologists Pleistocene and Holocene Geology on a Dynamic Coast Erie PA Oct. 1-3, 1987 includes Bathymetry of lake area around P.I., page 27 History of Shore Protection pg. 34	Hosts: Mercyhurst College, PA Geological Survey

	B.	The Geography and Geology of Erie County PA. 1967	Bureau of Topography and Geologic Survey
6. **Endangered Species**	A.	- Endangered and Threatened Species of of PA, 1985	Wild Resource Conservation Fund PA Fish Commission PA Game Commission
	B.	- Proposed Rulemaking - Game Commission lists protected Birds and Mammals	PA Bulletin Vol. 17 No. 10 March 7, 1987
	C.	- Areas of Concern for Bats Ken Anderson's Comments 9/88 Areas noted on P.I. Park Map	Ken Anderson Gannon University
	D.	- Species of Special Concern Computer Print-outs lists of Name - Status Name - Location Also includes specific comments	Received from DER - Obie Derr 1988
	E.	- Annex A, DER, Protection of Natural Resources --> became law June 88 --> Conservation of PA Native Wildflowers (Filed w/vegetation)	DER
7. **Aerial Photos**	A.	- '74 Black and whites "Large Scale"	
	B.	- April '86 Color Photos	Buffalo Dist. Corps of Engineers
	C.	- April '88 Color Photos Included Map w/ Photo Locations	
	D.	- September '88 Aerials "Color Snapshots"	RBA Data Collection
8. **Infra Reds**	A.	July 28, 1981	Paul Kaufman

9. **Design Studies**	A.	Final Phase I Vol. I General Design Memorandum EIS 1980 "Red Book"	Army Corps of Engineers
	B.	Final Phase I Vol. II General Design Memorandum EIS 1980 "Red Book"	Army Corps of Engineers
	NOTE:	These EIS's have been superseded by "Blue and White EIS"	Army Corps of Engineers
	C.	- Presque Isle Environmental Study. Construction of an East Access Bridge to P.I.	Michael Baker, Jr., Inc. Consulting Engineers June, 1974
	D.	- P.I. State Park Multi-Purpose Trail Feasibility Study Draft Report, 1986 Includes Species List	Keystone University Research Corp.
10. **Soils**	A.	- Soil and Water Conservation Plan Presque Isle State Park #352 Millcreek Twp. 1/86 Colored Maps 1"=660'	SCS
	B.	- Inventory and Evaluation of Soils at Presque Isle State Park, Jan. 1986	Charles T. Mitchell Soil Conservationist
	C.	- Resource Mgmt. Plan Soils Map 1"=800'	derived from SCS map
11. **Topography**	A.	- Topo Maps, Sheets 11A-11F 1"=200' Oct./1957 "Existing Conditions Map"	Dept. Forest and Waters
12. **Master Plan**	A.	- "Master Development Plan" 1"=200' Sheets 13A-F Oct./1957	

13.	**Mammals**	A. - Mammal Fauna of P.I. State Park "A Report on Present Knowledge"	Harry Cunningham, Jr., PhD
		B. - Data Collection Interview with Dr. Harry Cunningham, Mammals	September 1988, Penn State Behrend Campus
		C. - Data Collection Interview with Dr. Ken Anderson - Bats	September 1988, Gannon University
14.	**USGS Quads**	A. USGS Quad Sheets Erie North, PA Erie South, PA Swanville, PA Scale 1:24000 Date 1975	USGS
15.	**Herpetology**	A. Notes on the Herpetology of Presque Isle State Park, Erie PA	Vol. 11 No. 1 Bulletin Maryland Herpetological Society March 1975
		B. Herpetology of Presque Isle State Park, Erie PA	Vol. 23 No. 2 Bulletin MD Herp Society June 1987
		C. Data Collection Interview with Don McKinstry, Herptology	September, 1988 Penn State Behrend Campus
16.	**Fish**	A. Fishes of Presque Isle State Park and Surrounding Waters	Roger Kenyon and Frank Perise, May 1986
		B. Data Collection Interview with Bob Wellington, Erie Public Health Dept.	September, 1988

17.	Amphibians and Reptiles	A.	Amphibians and Reptiles of Presque Isle State Park, Erie, PA	Roger McPherson Clarion State College (no date)
		B.	Reptiles and Amphibians Species of Special Concern Base Map 1"=800'	Don McKinstry Penn State Bchrend Campus, 1986
18.	Invertebrates	A.	Invertebrates of Presque Isle, Erie PA	E.C. Masteller, Penn State Behrend Campus, 1985
19.	M.A.P.	A.	The Map Analysis Package: MAP-for-the PC Version 2.0	Ohio State University October, 1987
20.	General --> Detailed	A.	Resource Management Plan Report - Appendix includes Historic List, Veg, Mammals, Fish, Reptiles, Birds, Hydrarch Succession, etc.	Citizens Group PA DER, 1986
			Base Map 1"=800'	
			Soil Map 1"=800'	
			Vegetation Map 1"=800'	B. of Forestry
			Wetlands & Deepwater Habitats 1:24,000	US Fish & Wildlife
21.	General	A.	Coastal Tidings - Newsletter Management Plan updates, news briefs, Hairy Puccoon	PA Coastal Zone Mgmt Newsletter

22.	**Bench Marks**	A.	Presque Isle State Park Bench Marks - Lists Management Regions P.I. falls within	Aerial Map Service Co.
23.	**Concrete Monuments**	A.	Existing Conditions Map 1"=200' Sheet 10 Oct/1957 Concrete Monuments Coordinates and Elevations	Dept. of Forests & Waters
	Mylars	A.	400 and 800 Scale Base Map (Negative Also)	
		B.	400 and 800 Scale Soils (DER Report)	
		C.	400 and 800 Scale Vegetation (DER Report) ___ Scale NOAA Map 800 Scale USGS	
	Opti-Negs	A.	Base Map (DER Report)	
		B.	Soils Map (DER Report)	
		C.	Vegetation Map (DER Report)	
		D.	NOAA Map	
		E.	USGS	

APPENDIX D

LIST OF WORKSHOP

PARTICIPANTS

Sign In

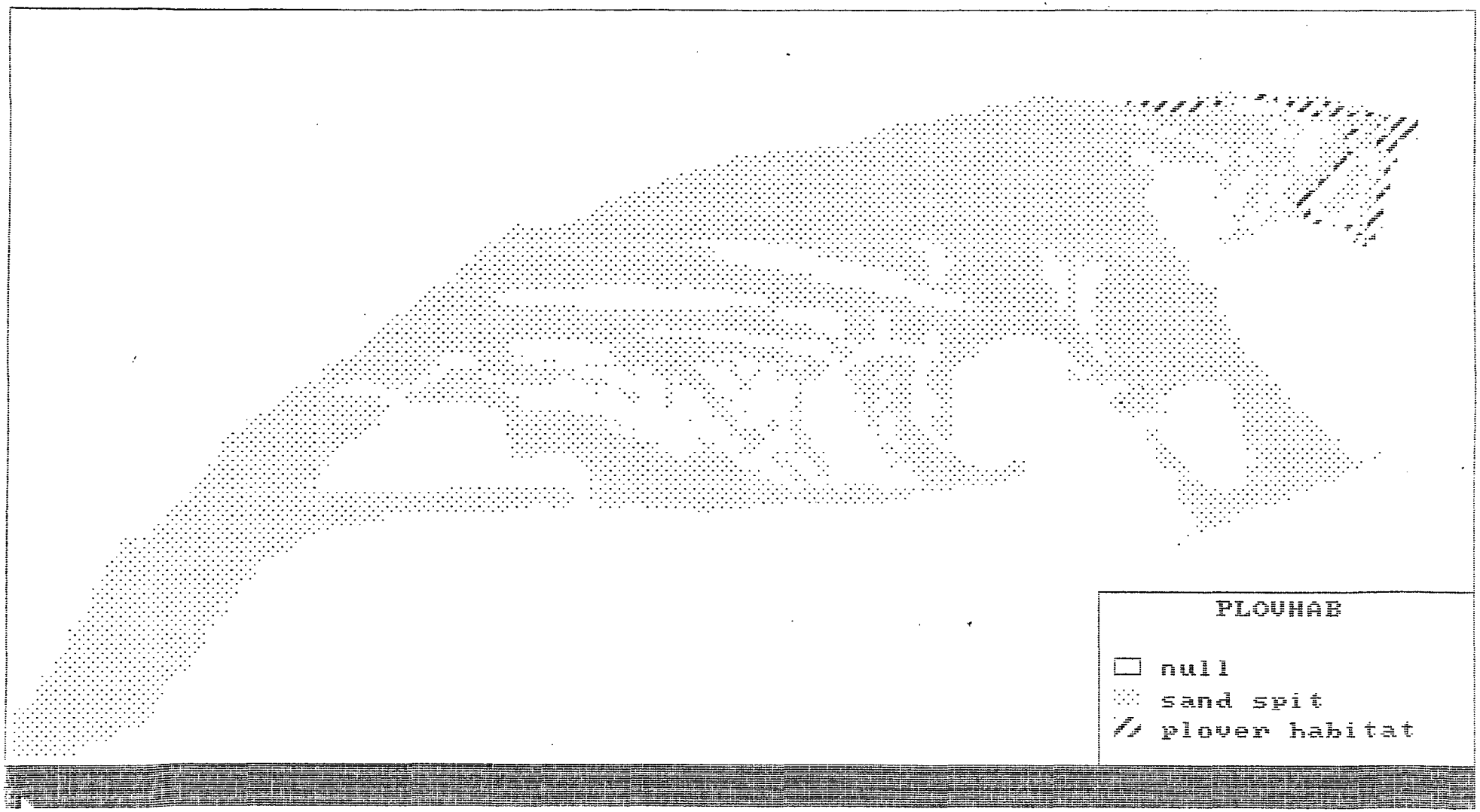
NAME	ADDRESS	PHONE
Jim Bissell	Cleveland Museum of Natural History	216-231-4600
Charles Bier	Western PA Conservancy, Pgh	412 2882777
Paul Eagles	Dept of Recreation + Leisure Studies University of Waterloo	519-885-1211 x2716
Ohio Dem	State Chair	
Paul [illegible] V.	Presque Isle Advisory Comm.	H-(814) 734 1542 O (814) 732-2840
Roger Kenyon	Box 531, Fairview PA	474 1515
Harry Cunningham	Penn State-Behrend.-Erie 16563	898-6403-O 825-5044-H
Beverly Danielson	Cleveland Museum of Natural History	216-231-4600
Jean Stull	661 Benson, Waterford, Pa	(814) 796-2070
Robert Wellington	Erie County Dept Health - 606 West 3rd Erie	814-451-6700
Dane Tomlin	Ohio State University	614-292-8475
Gary Bloss	The RBA Group	(201) 893-0300

APPENDIX E

SAMPLING OF

OVERLAY COMPONENT DISPLAYS

FOR ANALYSIS MODELS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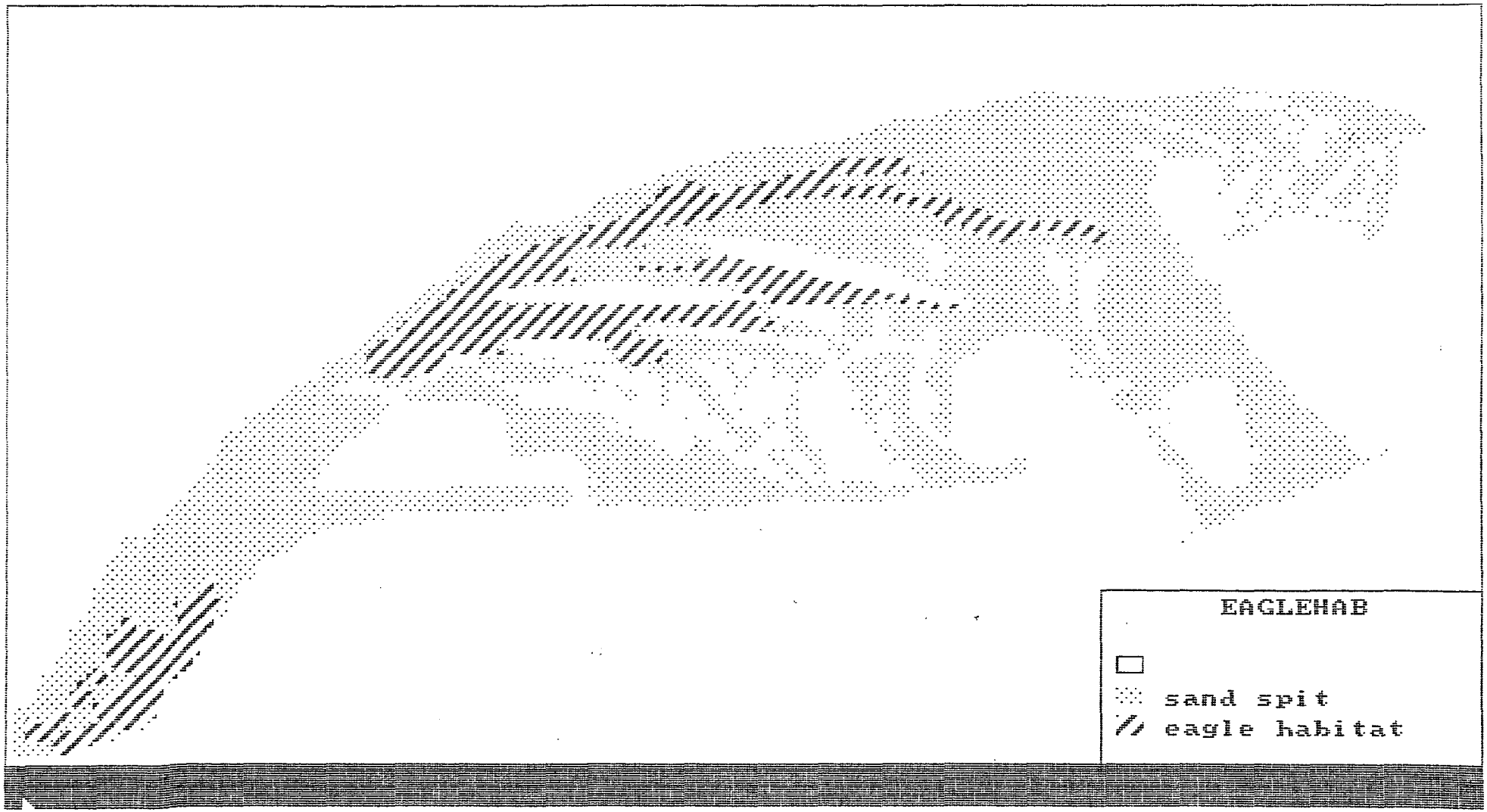
plover habitat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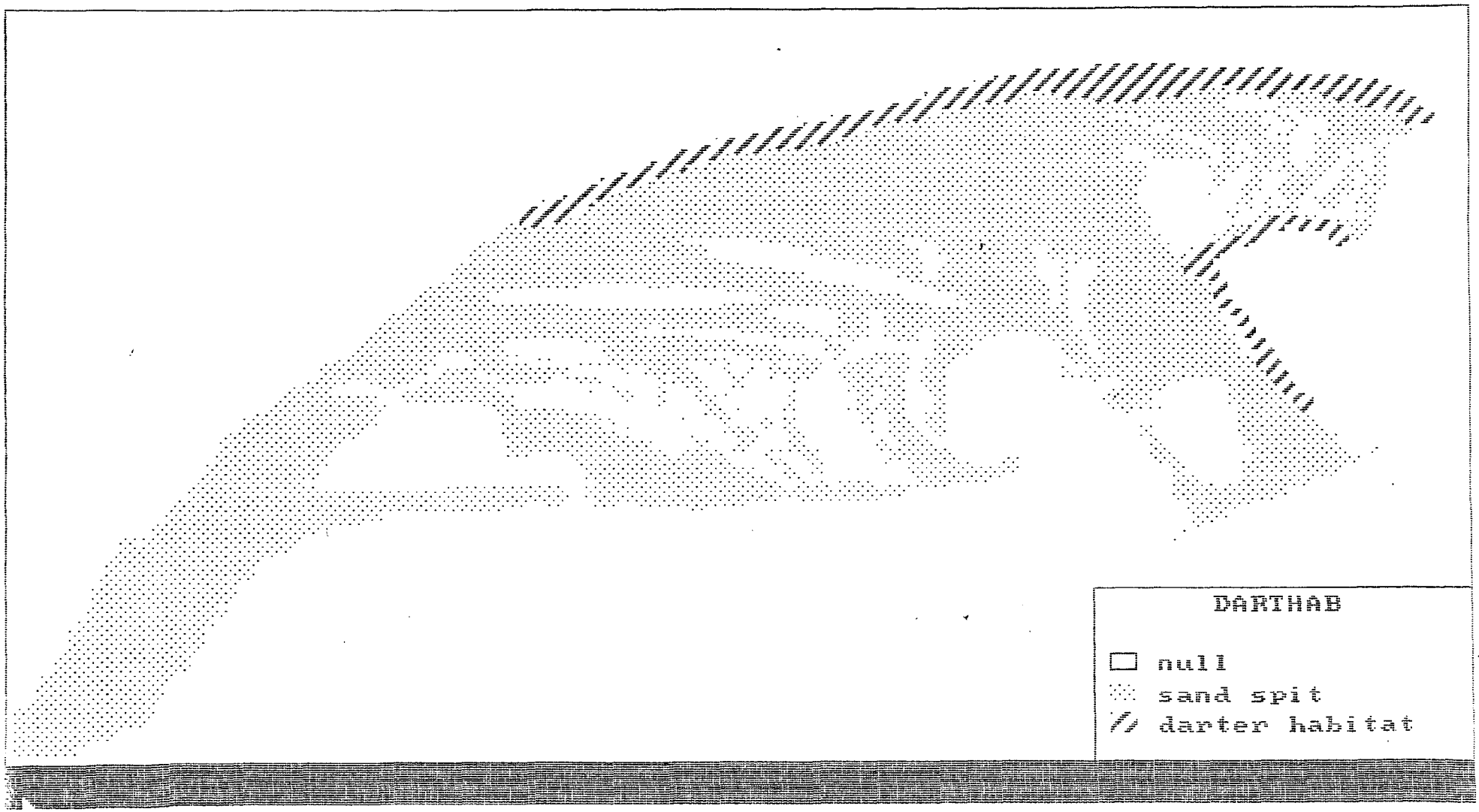
eagle habitat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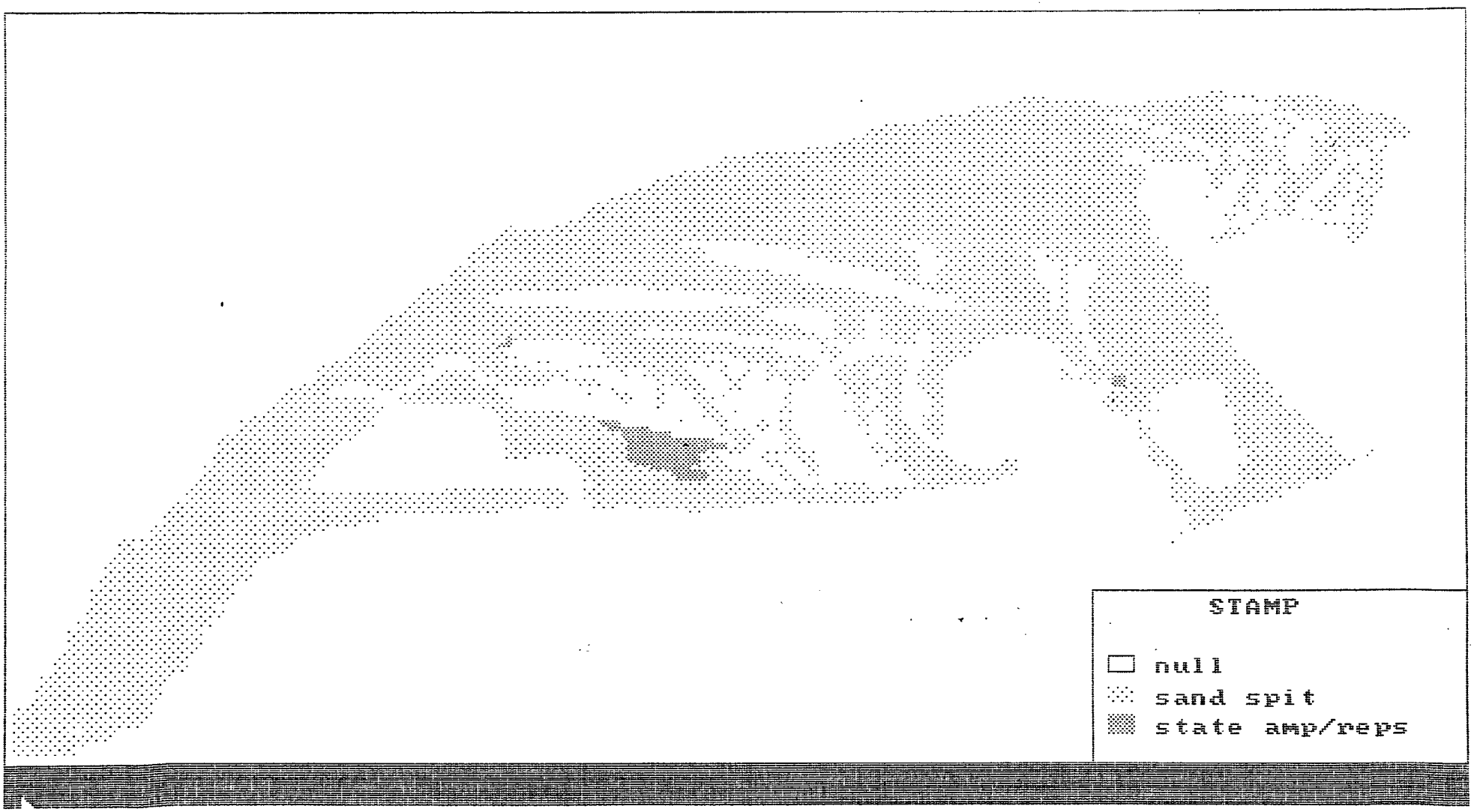
darter habitat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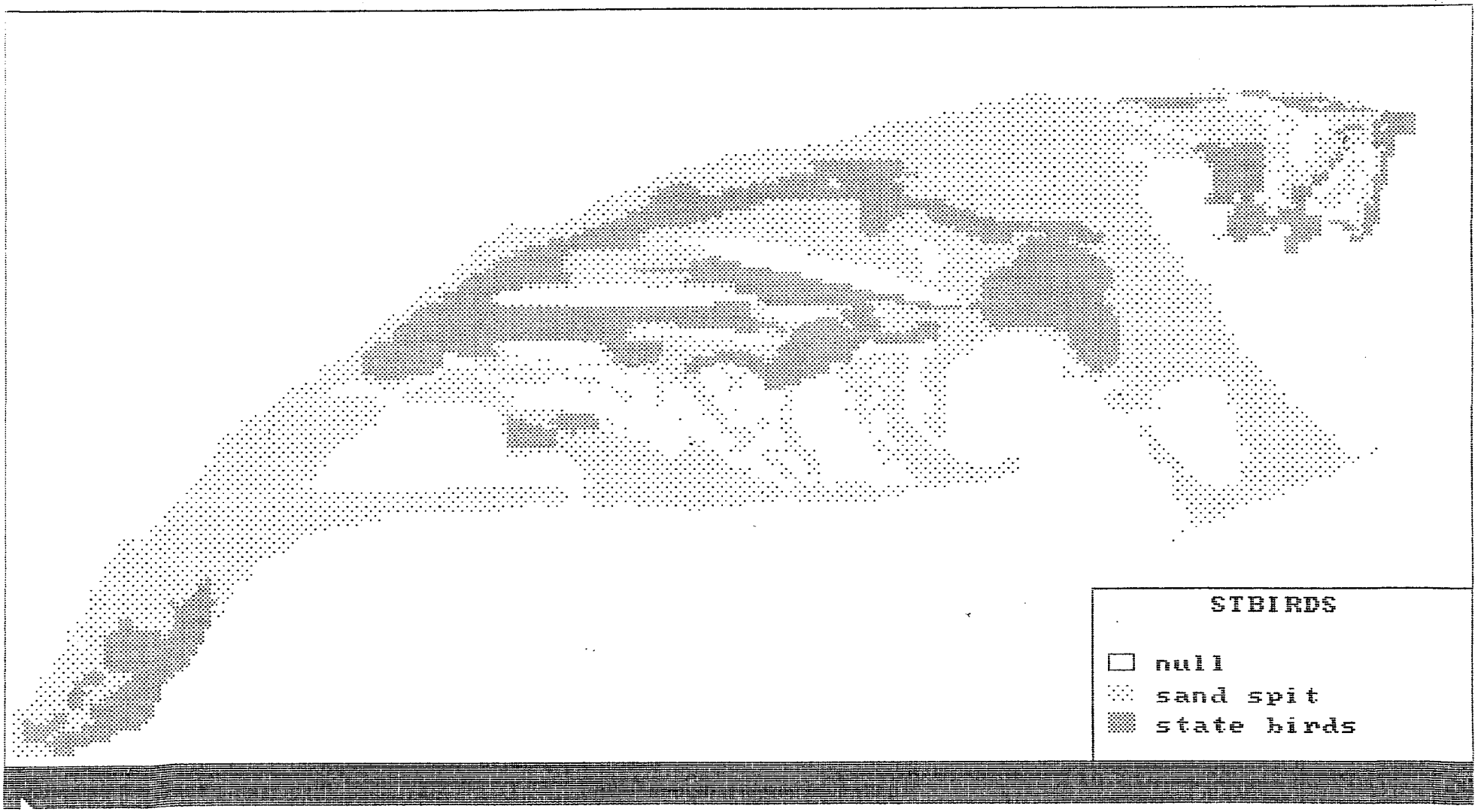
state amp/reps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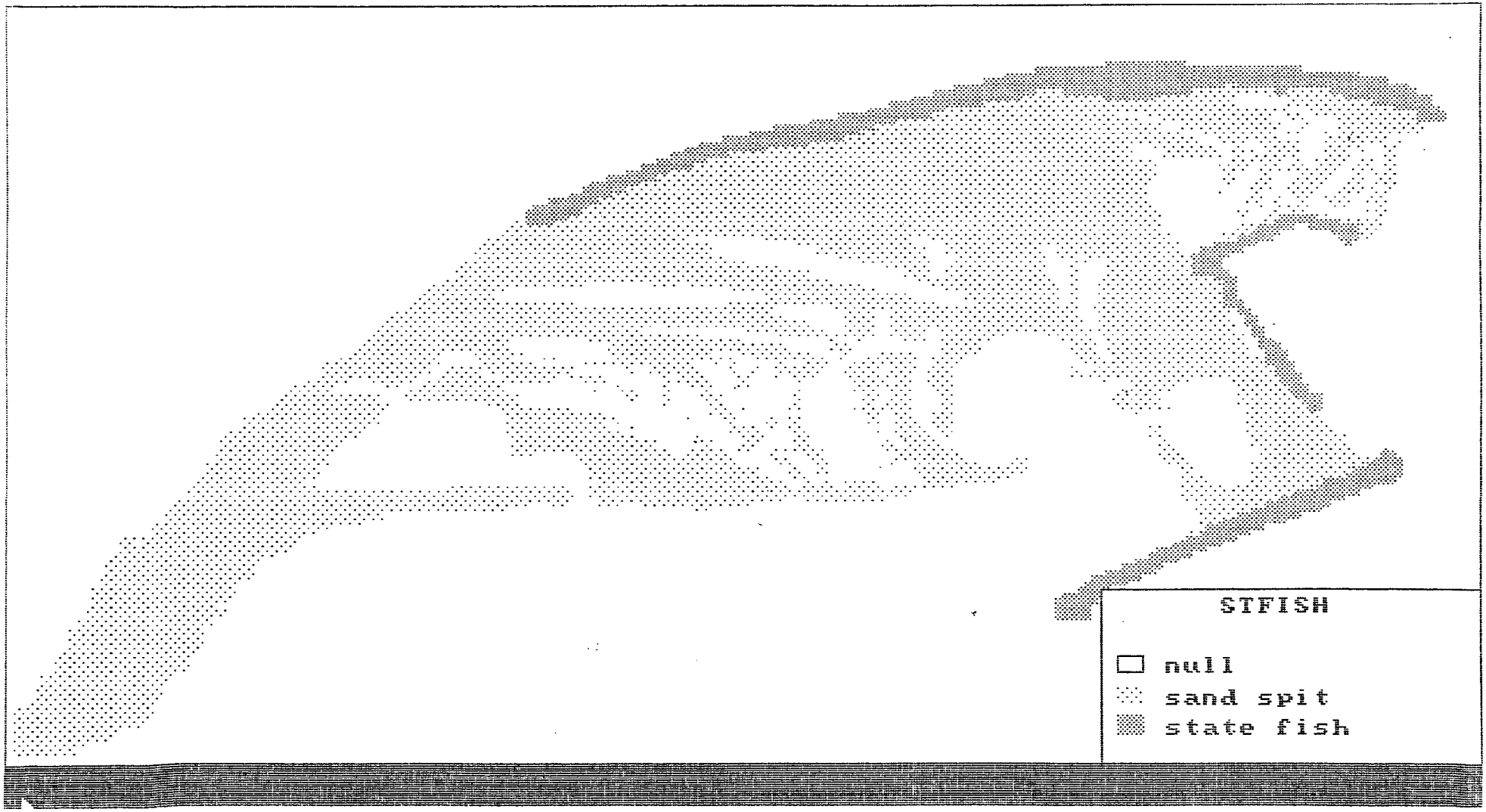
state birds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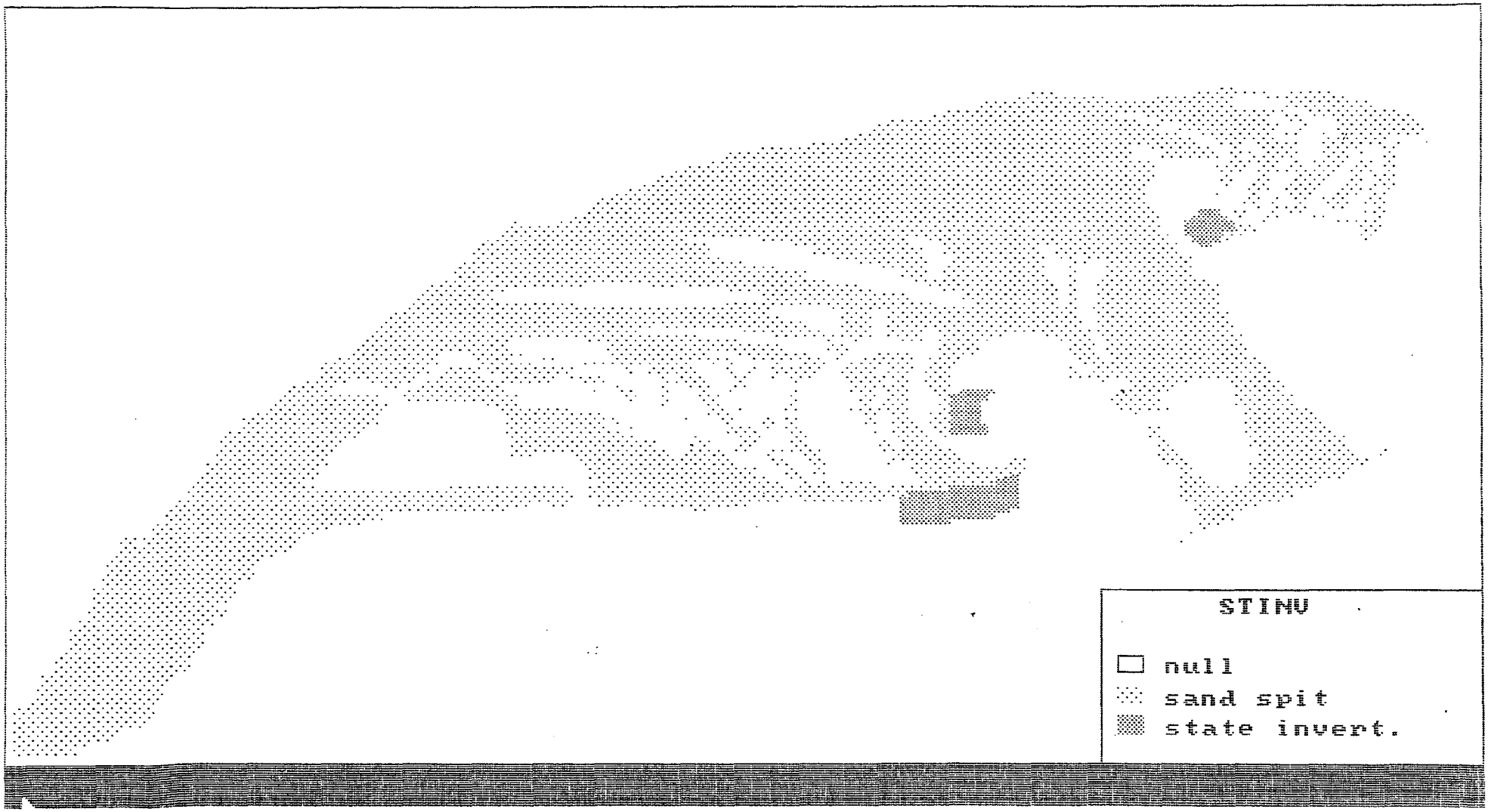
state fish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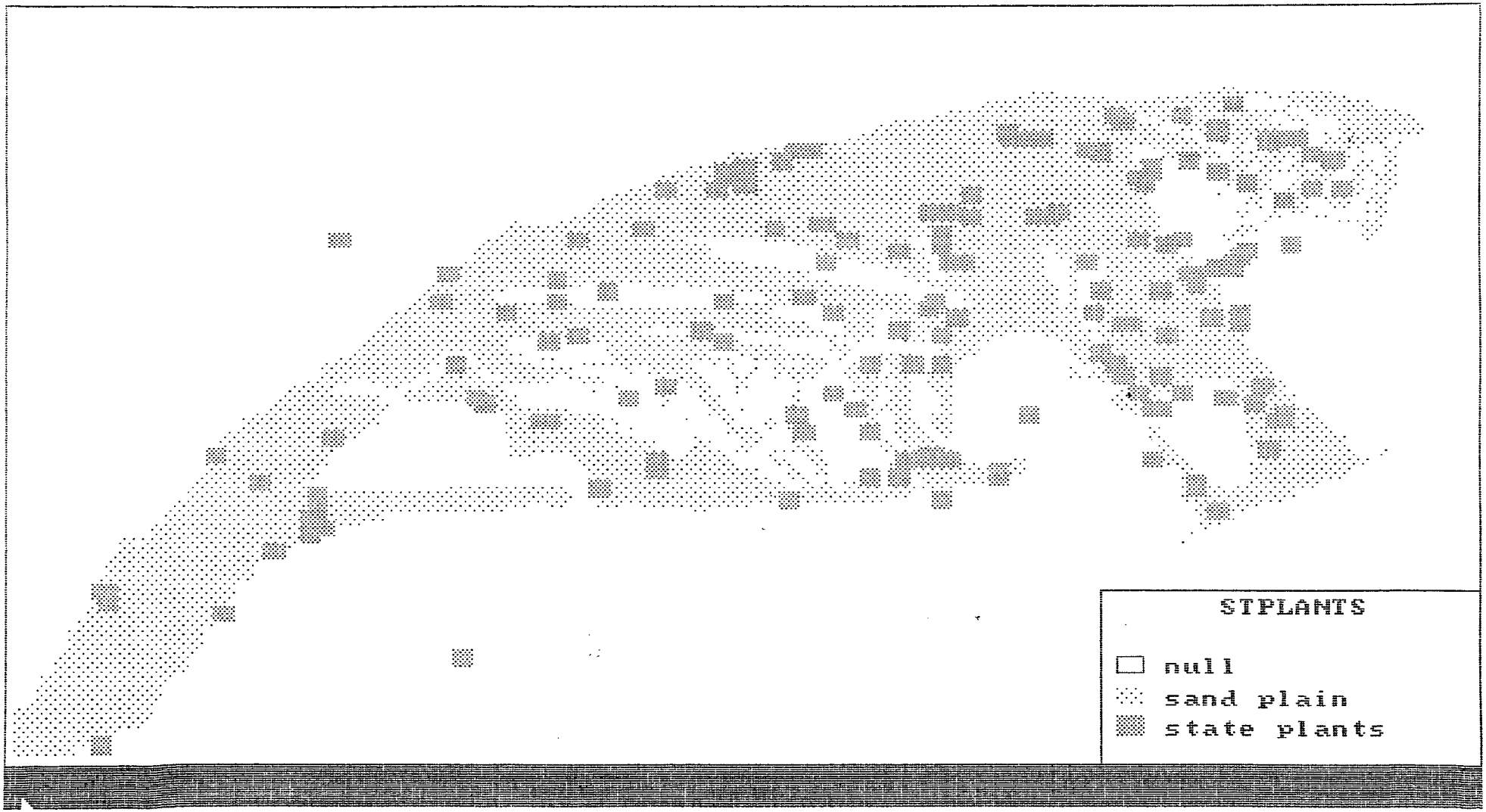
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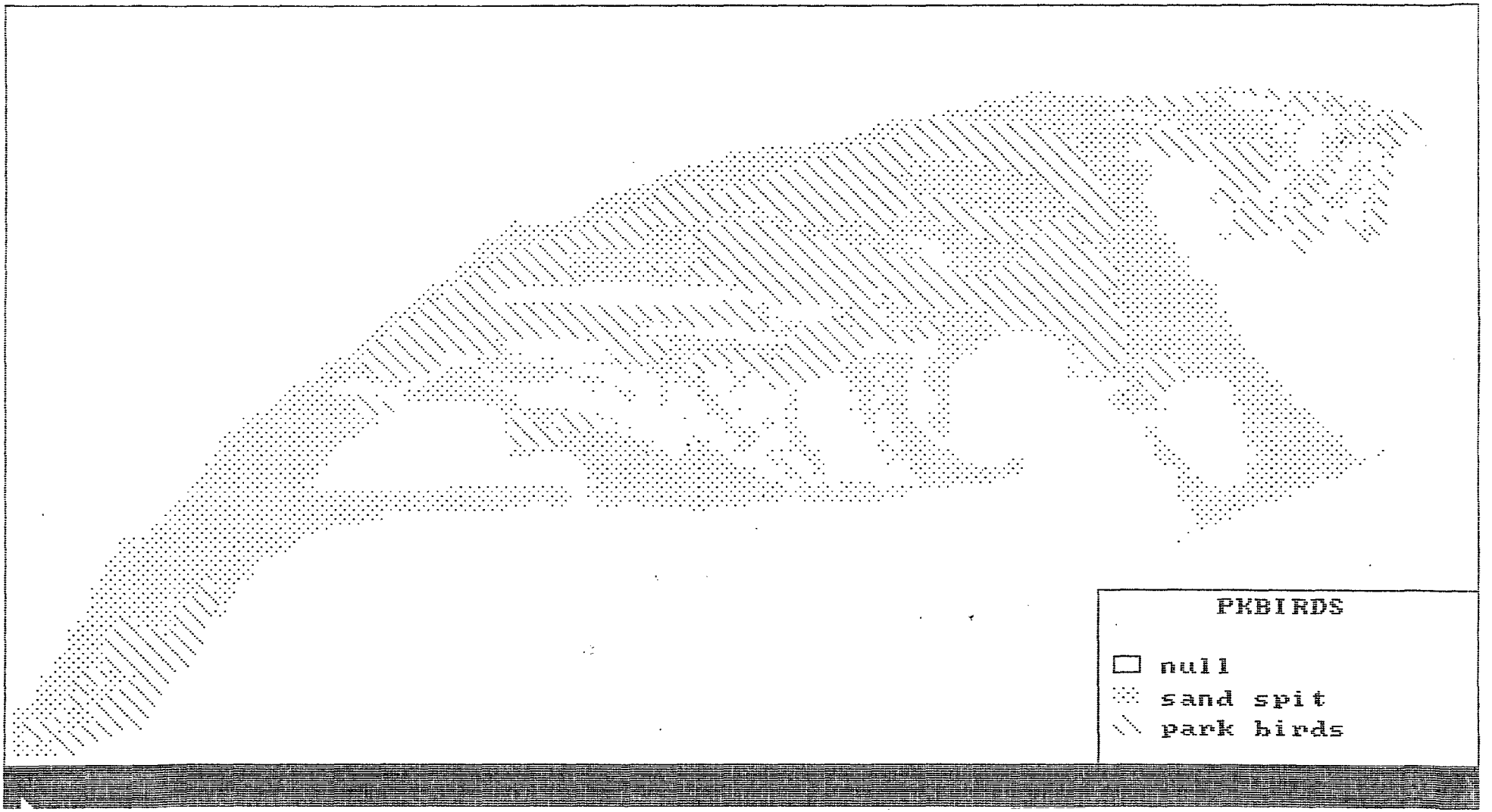
state plants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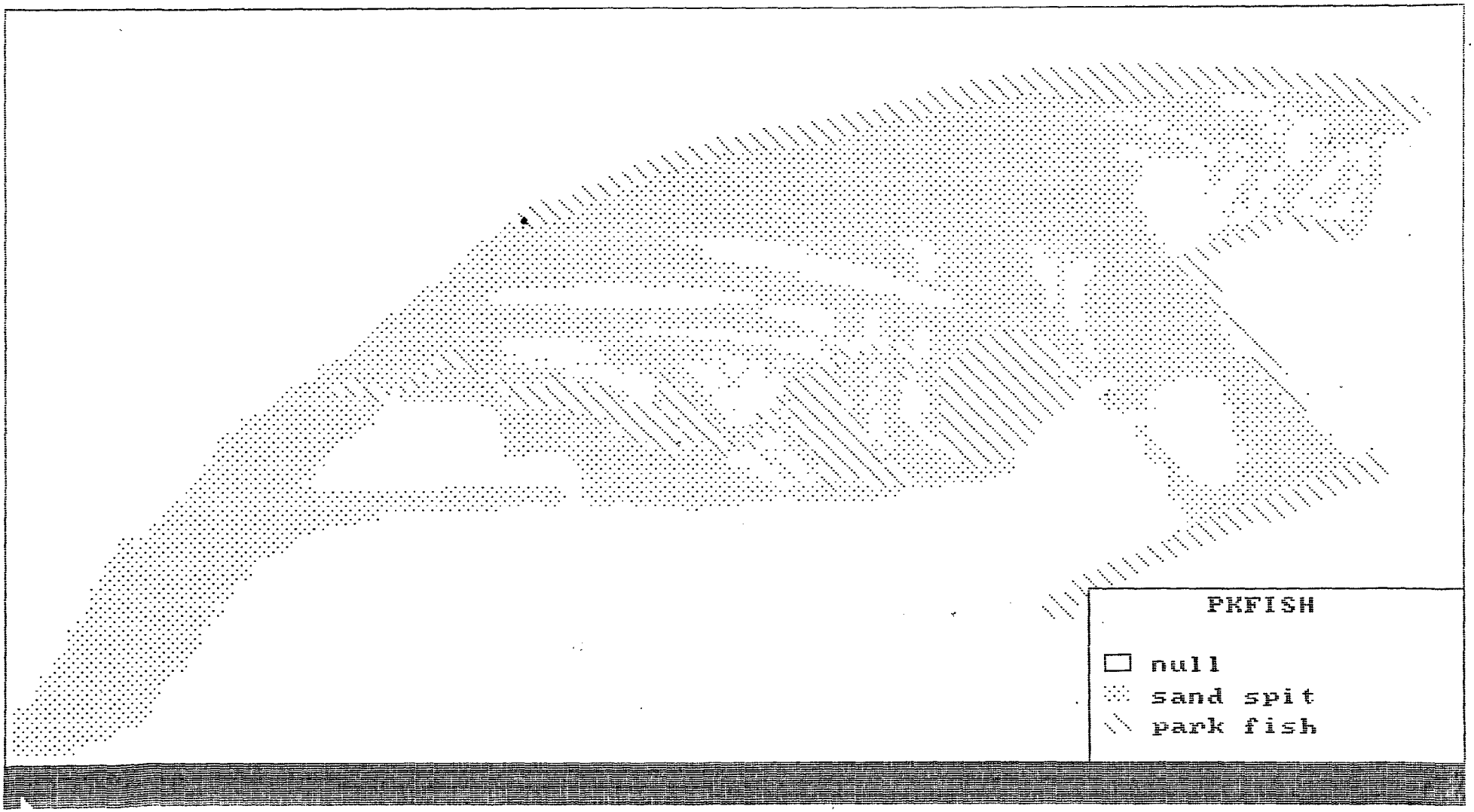
park birds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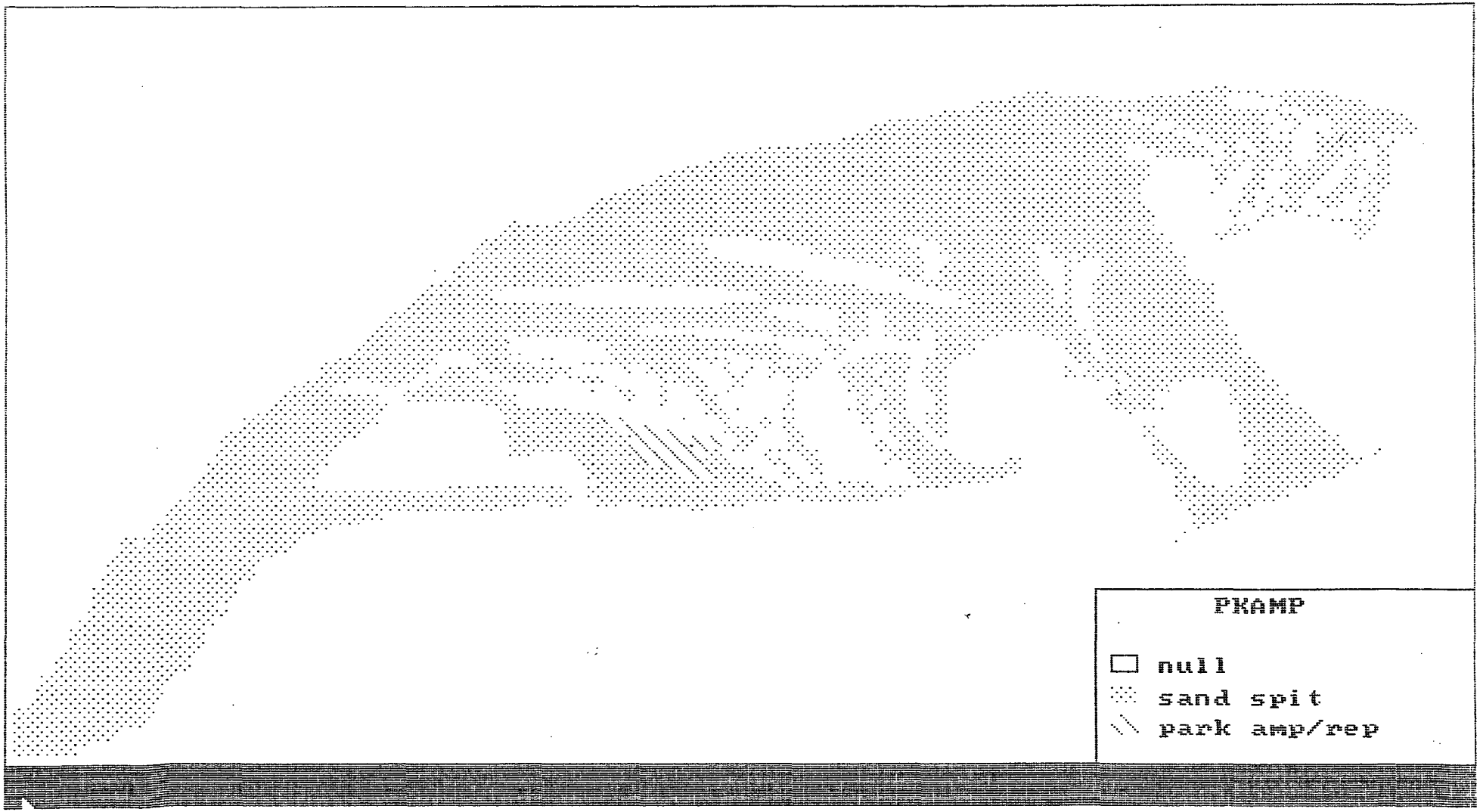
sand spit
park fish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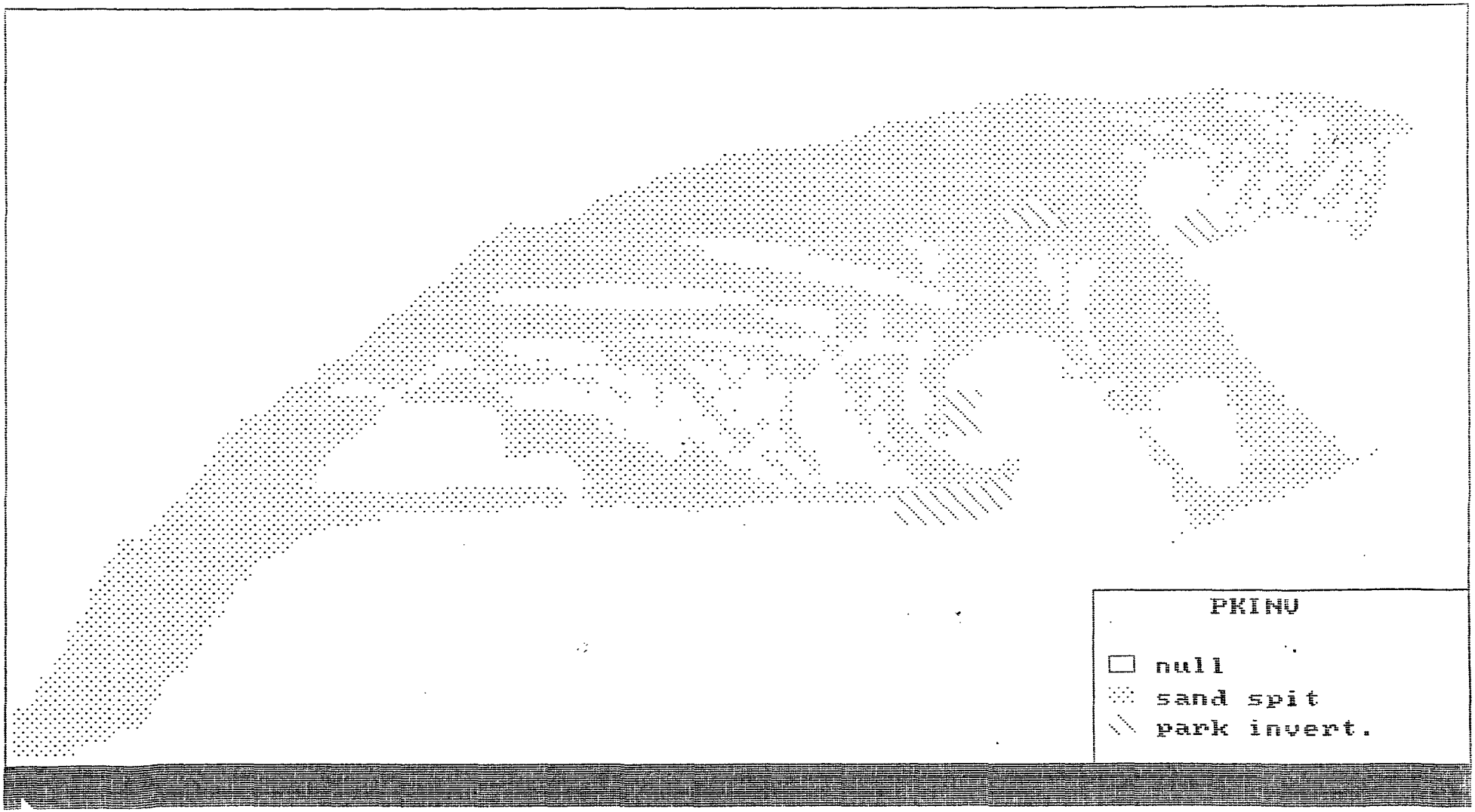
sand spit
park amp/rep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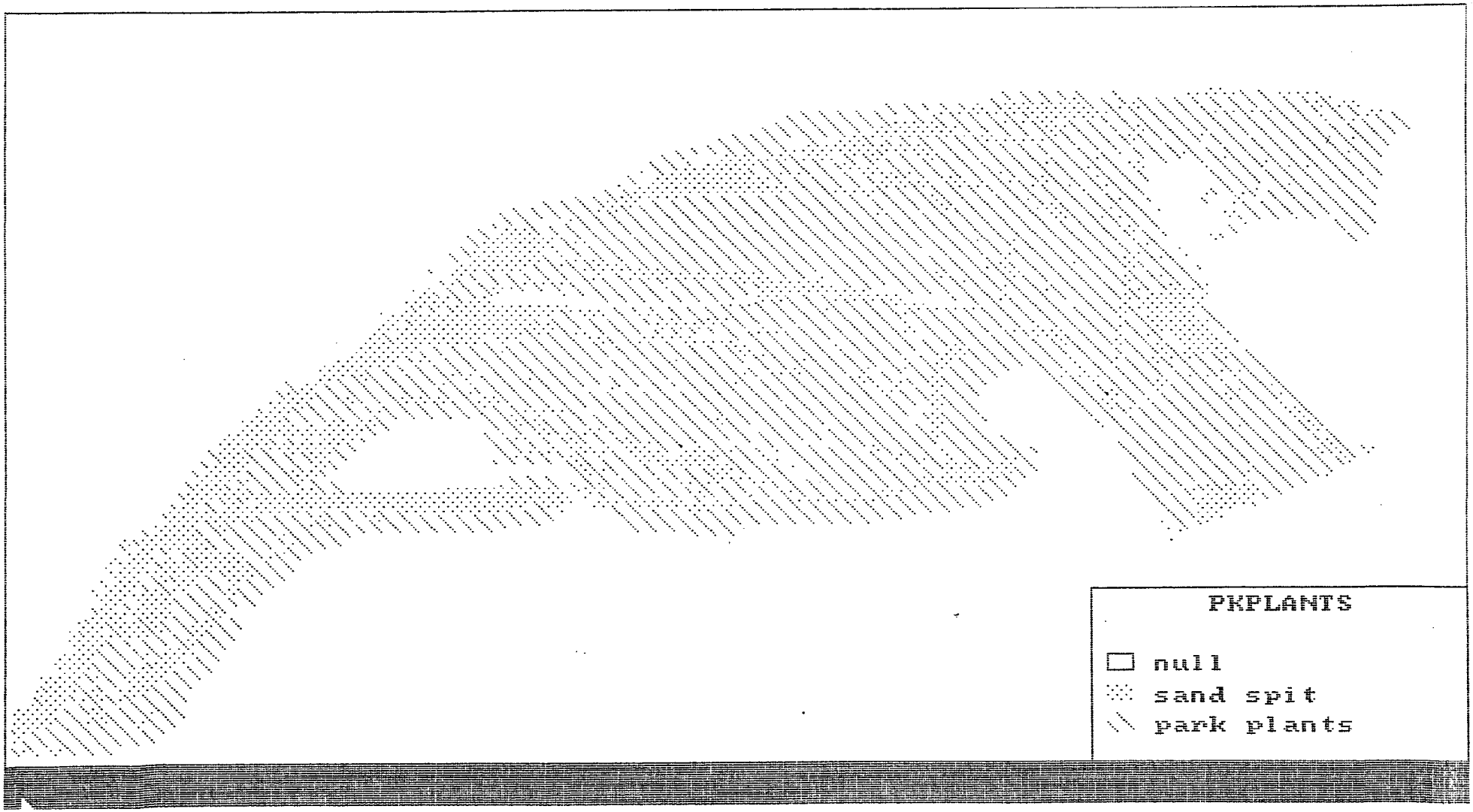
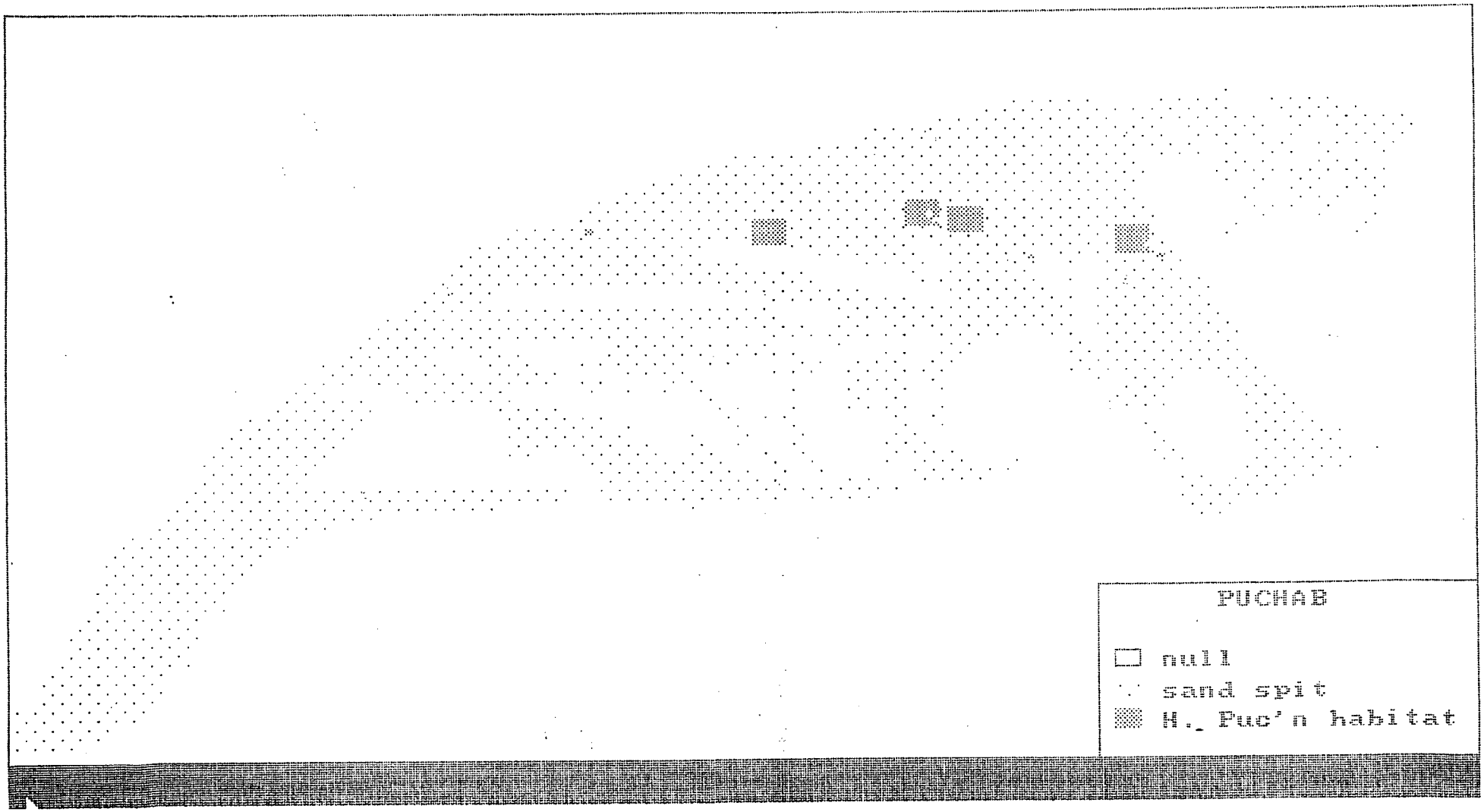
null
sand spit
park invert.


PKPLANTS
null
sand spit
park plants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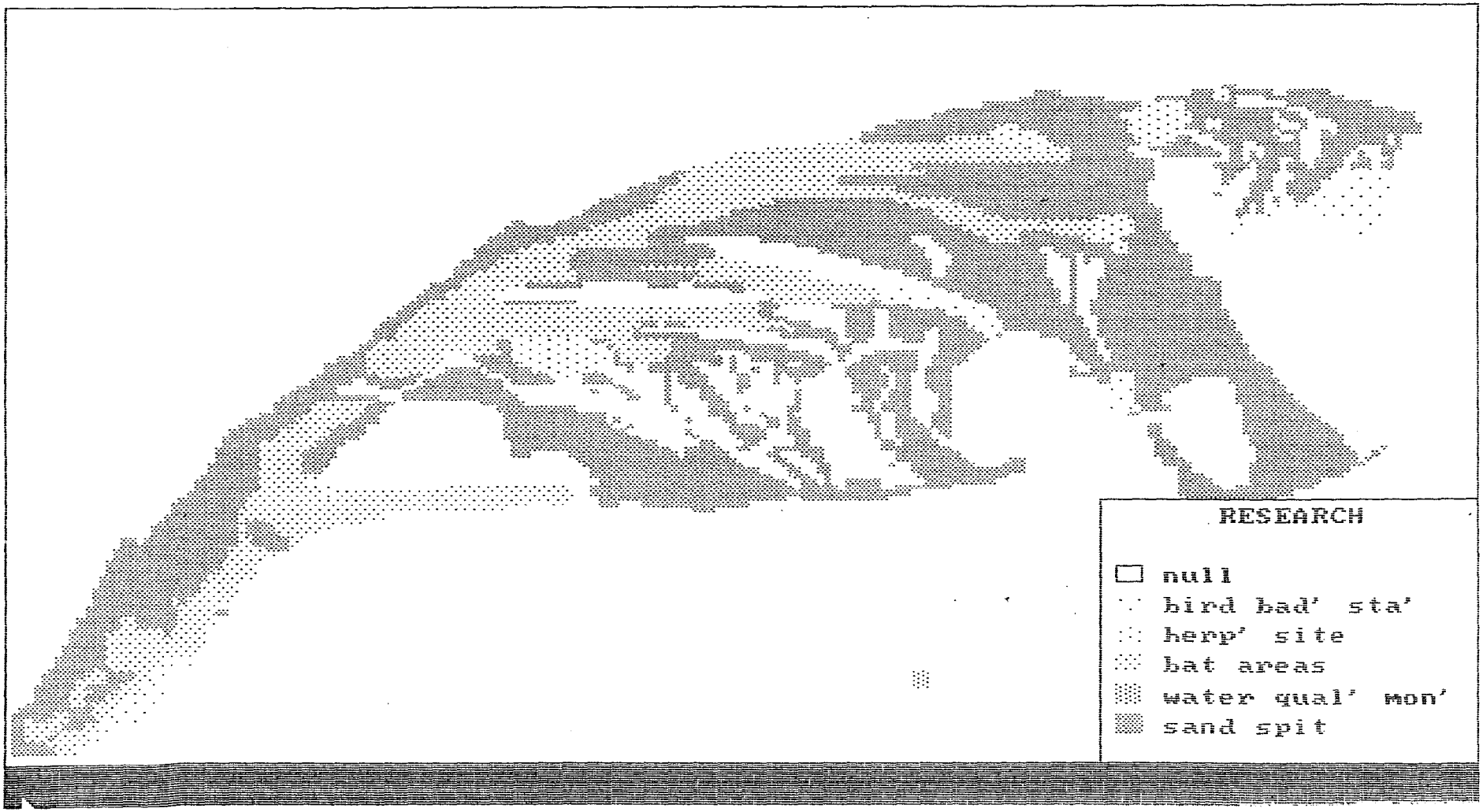
H. Puc'n habitat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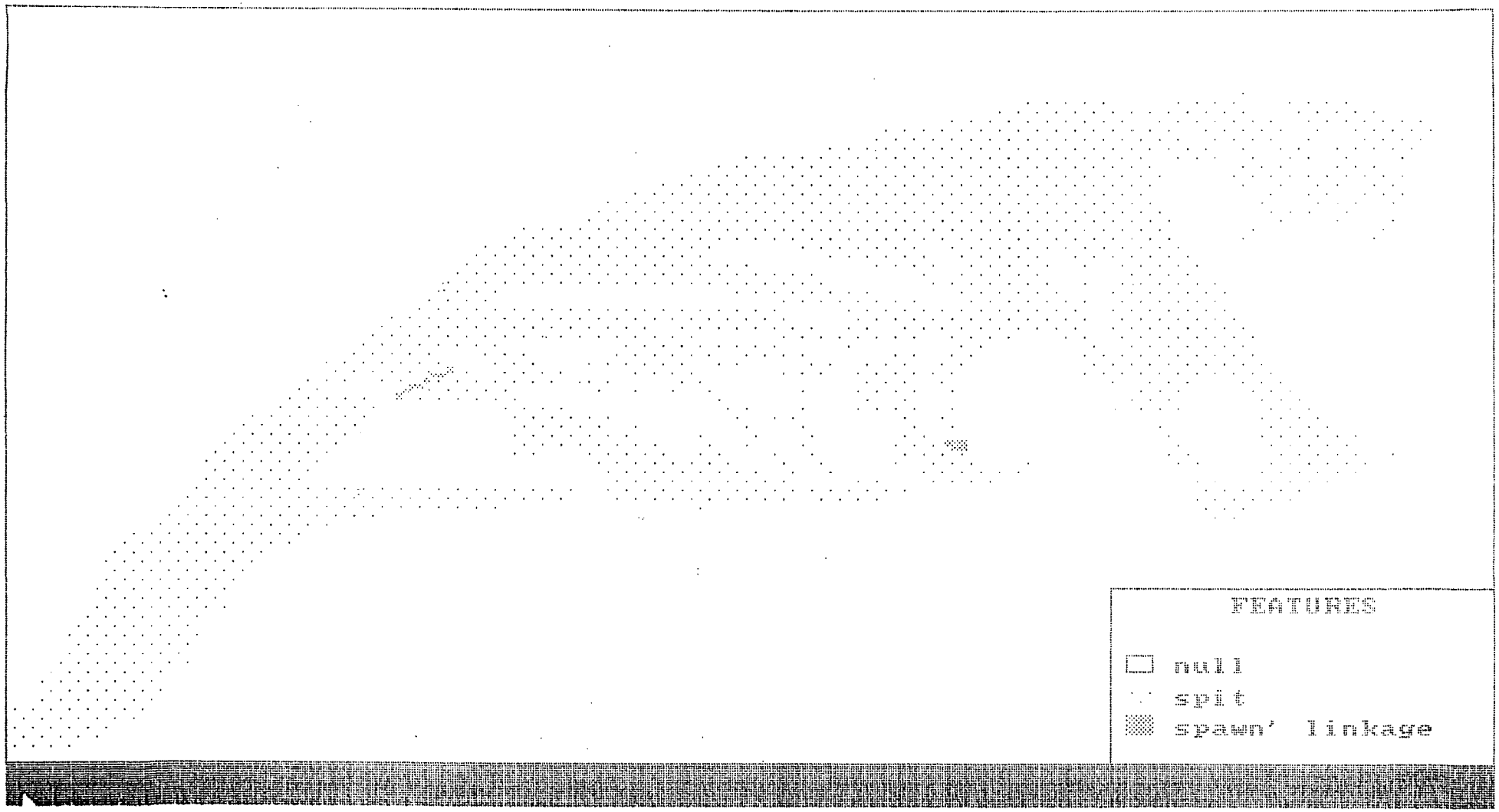
herp' site
bat areas
water qual' mon'
sand spit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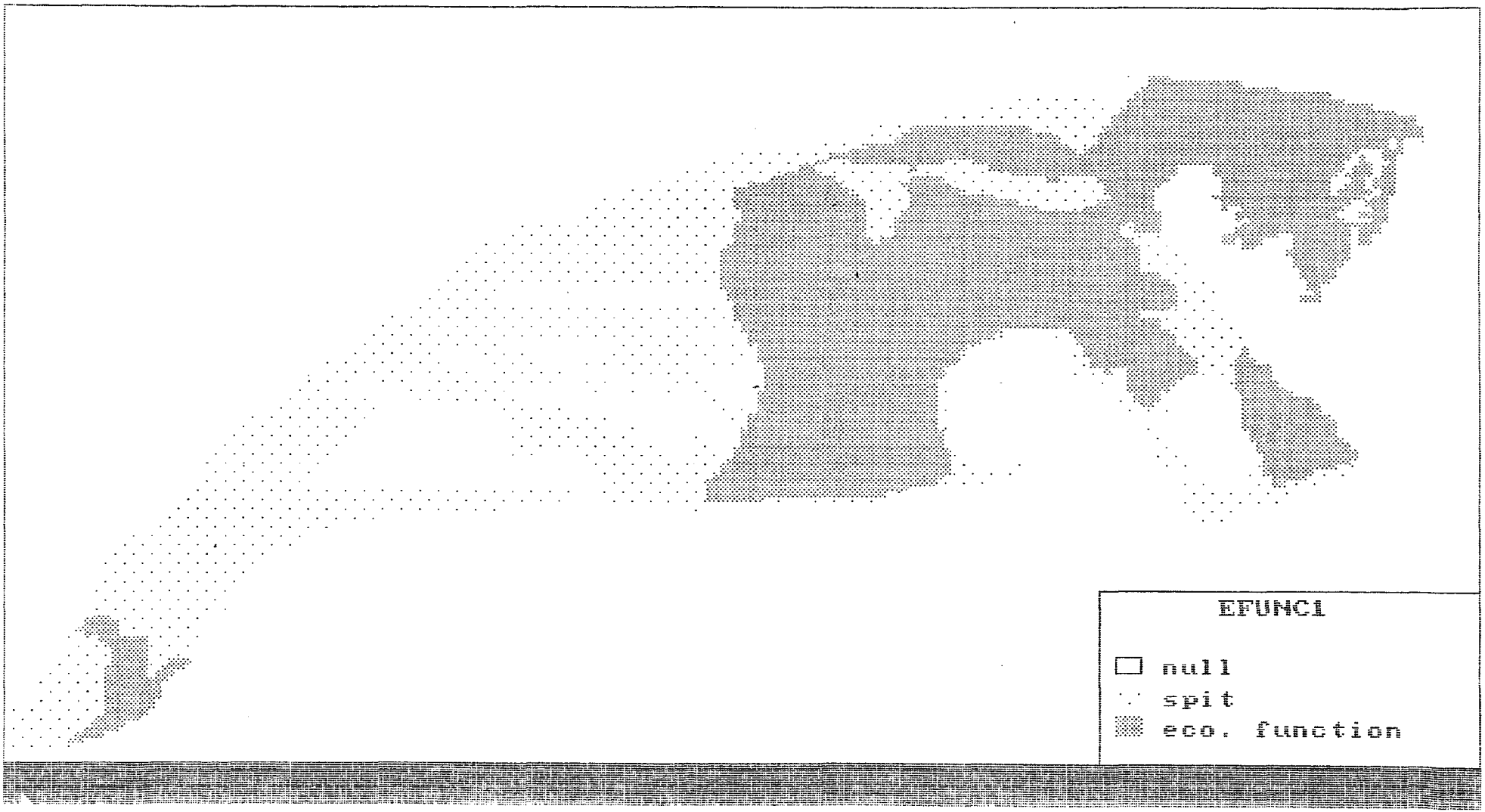
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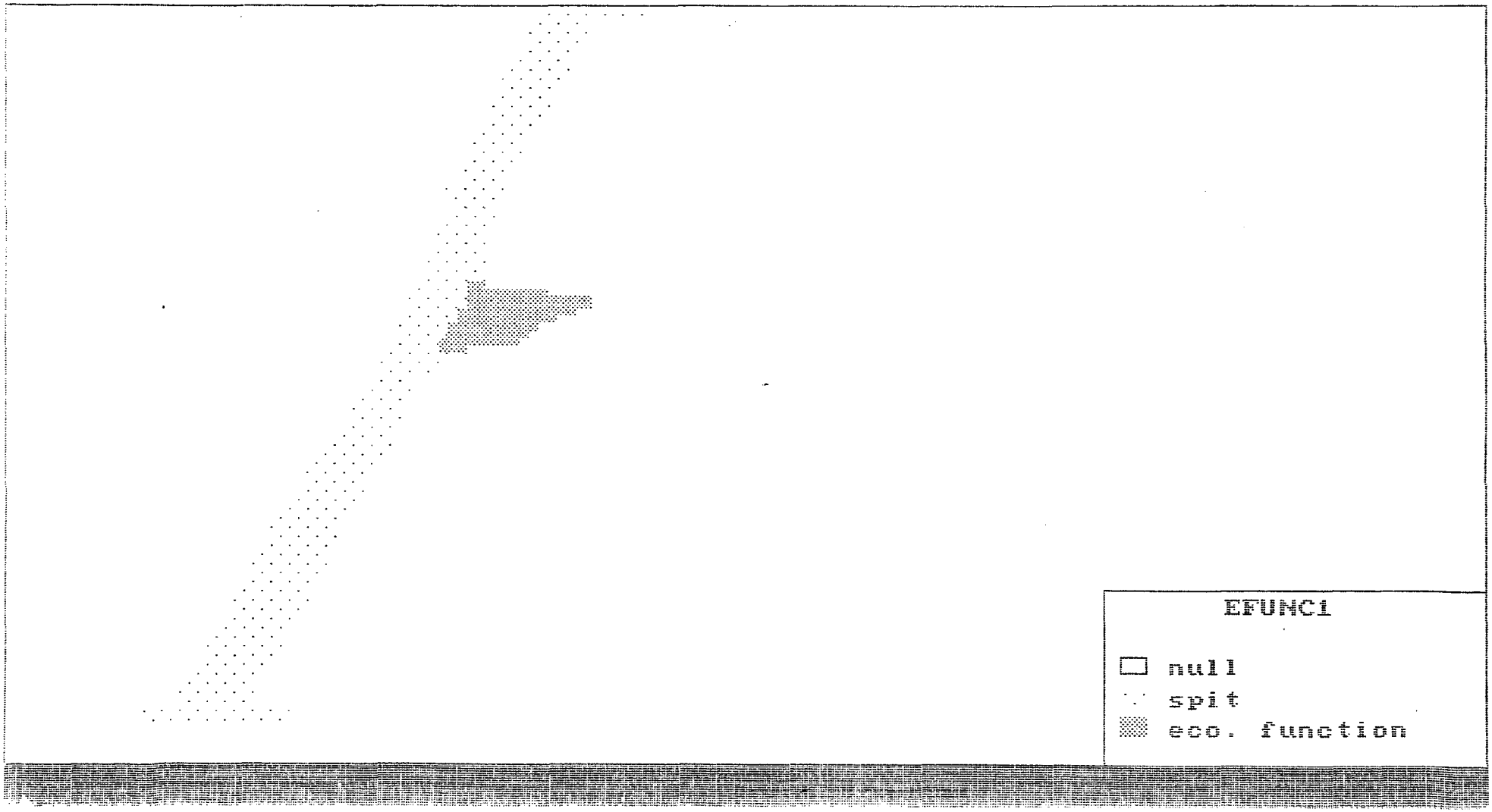
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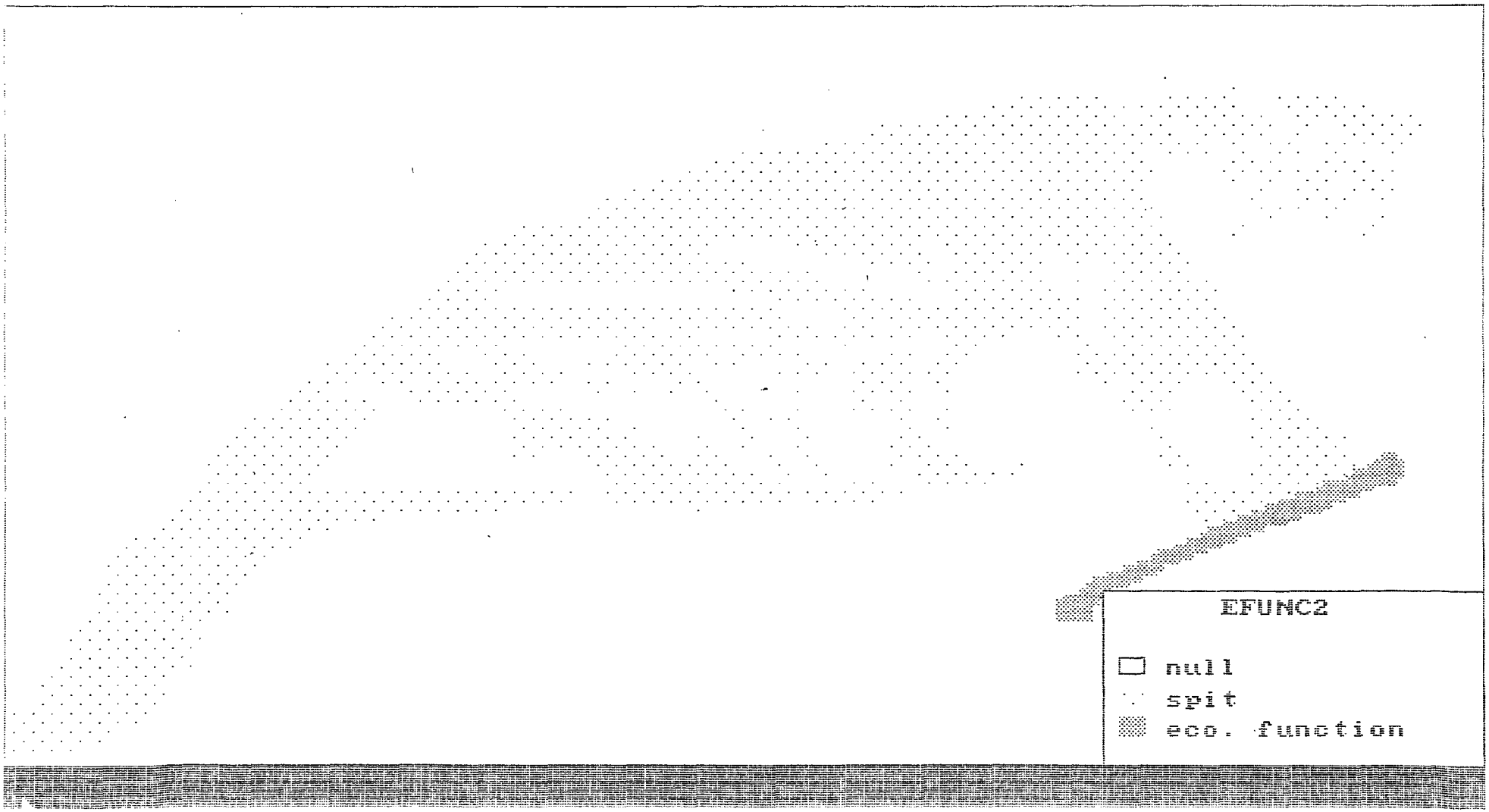
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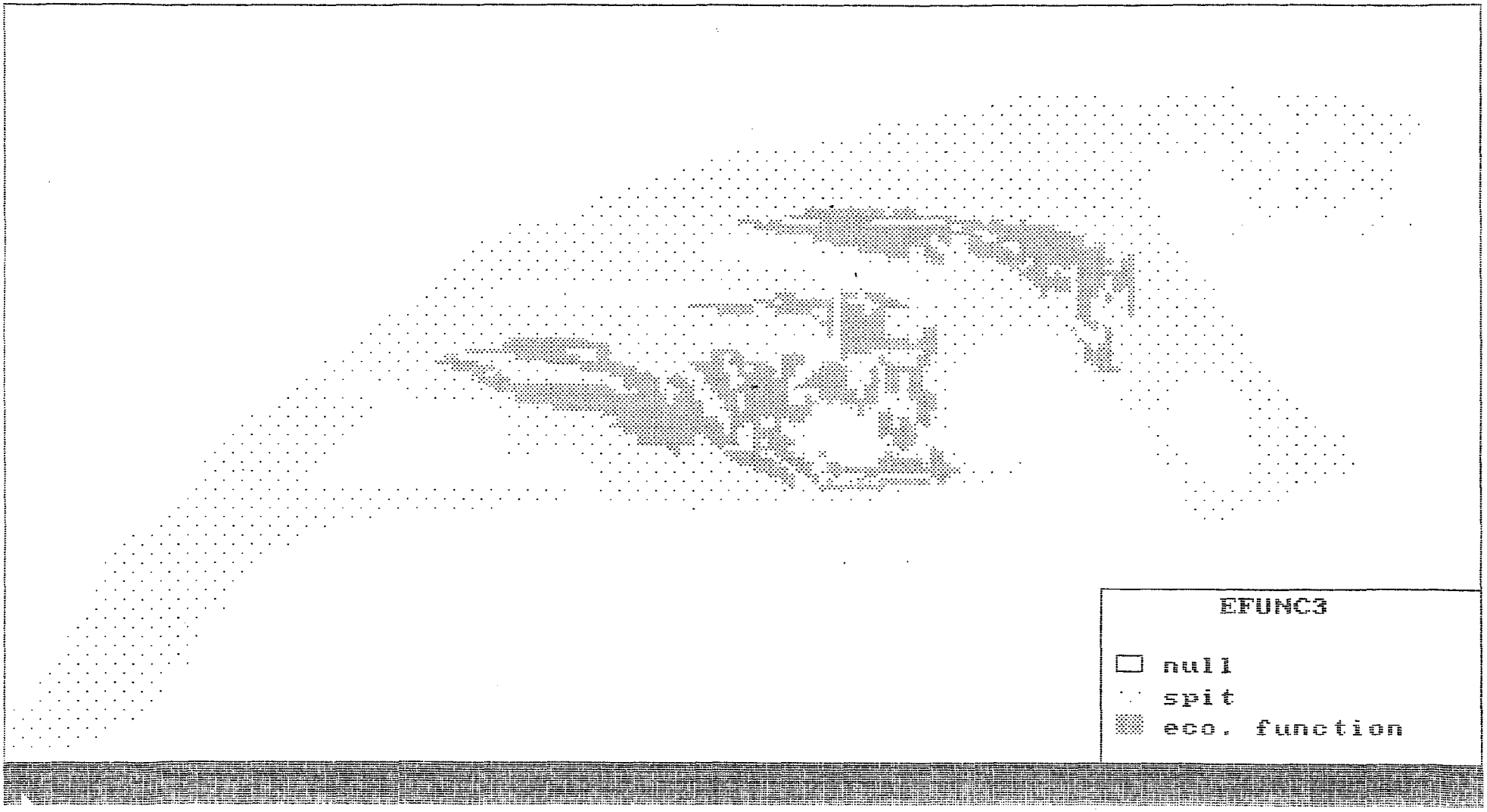
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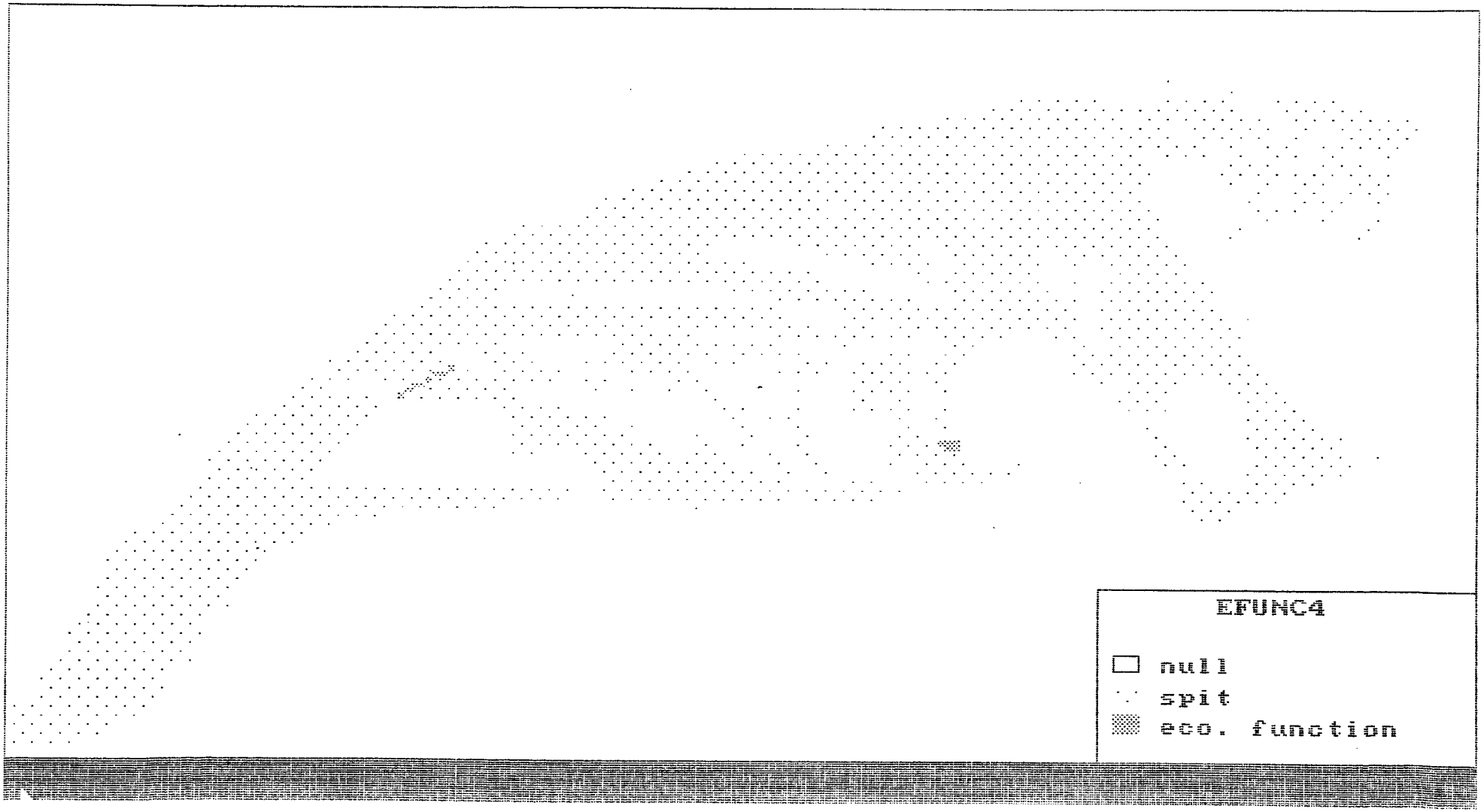
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APPENDIX F

ESA SCORES

ESAS scored against **MODELA** - Species of Special Concern (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	5879	16.54	.31
1 ESA I	509	1.96	5090	14.32	10.00
2 ESA II	138	.53	1380	3.88	10.00
3 ESA III	1034	3.98	3252	9.15	3.15
4 ESA IV	200	.77	1000	2.81	5.00
5 ESA V	230	.88	375	1.06	1.63
6 ESA VI	47	.18	94	.26	2.00
7 ESA VII	77	.30	175	.49	2.27
8 ESA VIII	4121	15.85	15757	44.33	3.82
9 ESA IX	14	.05	45	.13	3.21
10 ESA X	36	.14	180	.51	5.00
11 ESA XI	95	.37	475	1.34	5.00
12 ESA XII	49	.19	151	.42	3.08
13 ESA XIII	114	.44	210	.59	1.84
14 ESA XIV	162	.62	172	.48	1.06
15 ESA XV	86	.33	182	.51	2.12
16 ESA XVI	44	.17	359	1.01	8.16
17 ESA XVII	82	.32	765	2.15	9.33
MAP LAYER TOTAL	26000		35541		1.00

MODELA

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	17227	66.26	4544	9.30	.26
1 Park	4601	17.70	21540	44.06	4.68
5 State	2156	8.29	12469	25.51	5.78
10 Federal	2016	7.75	10330	21.13	5.12
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELA**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	16614	63.90	87.62	96.44	92.03
0 null	1 Park	1749	6.73	9.22	38.01	23.62
0 null	5 State	372	1.43	1.96	17.25	9.61
0 null	10 Federal	227	.87	1.20	11.26	6.23
1 ESA I	10 Federal	509	1.96	100.00	25.25	62.62
2 ESA II	10 Federal	138	.53	100.00	6.85	53.42
3 ESA III	0 null	173	.67	16.73	1.00	8.87

ESAS scored against **MODELA** - Species of Special Concern (n wndo. cont.):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELA**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
3 ESA III	1 Park	417	1.60	40.33	9.06	24.70
3 ESA III	5 State	321	1.23	31.04	14.89	22.97
3 ESA III	10 Federal	123	.47	11.90	6.10	9.00
4 ESA IV	5 State	200	.77	100.00	9.28	54.64
5 ESA V	0 null	35	.13	15.22	.20	7.71
5 ESA V	1 Park	150	.58	65.22	3.26	34.24
5 ESA V	5 State	45	.17	19.57	2.09	10.83
6 ESA VI	0 null	5	.02	10.64	.03	5.33
6 ESA VI	1 Park	29	.11	61.70	.63	31.17
6 ESA VI	5 State	13	.05	27.66	.60	14.13
7 ESA VII	0 null	10	.04	12.99	.06	6.52
7 ESA VII	1 Park	40	.15	51.95	.87	26.41
7 ESA VII	5 State	27	.10	35.06	1.25	18.16
8 ESA VIII	0 null	280	1.08	6.79	1.63	4.21
8 ESA VIII	1 Park	1982	7.62	48.10	43.08	45.59
8 ESA VIII	5 State	963	3.70	23.37	44.67	34.02
8 ESA VIII	10 Federal	896	3.45	21.74	44.44	33.09
9 ESA IX	0 null	1	.00	7.14	.01	3.57
9 ESA IX	1 Park	5	.02	35.71	.11	17.91
9 ESA IX	5 State	8	.03	57.14	.37	28.76
10 ESA X	5 State	36	.14	100.00	1.67	50.83
11 ESA XI	5 State	95	.37	100.00	4.41	52.20
12 ESA XII	0 null	10	.04	20.41	.06	10.23
12 ESA XII	1 Park	11	.04	22.45	.24	11.34
12 ESA XII	5 State	28	.11	57.14	1.30	29.22
13 ESA XIII	0 null	12	.05	10.53	.07	5.30
13 ESA XIII	1 Park	90	.35	78.95	1.96	40.45
13 ESA XIII	10 Federal	12	.05	10.53	.60	5.56
14 ESA XIV	0 null	82	.32	50.62	.48	25.55
14 ESA XIV	1 Park	57	.22	35.19	1.24	18.21
14 ESA XIV	5 State	23	.09	14.20	1.07	7.63
15 ESA XV	0 null	4	.02	4.65	.02	2.34
15 ESA XV	1 Park	57	.22	66.28	1.24	33.76
15 ESA XV	5 State	25	.10	29.07	1.16	15.11

ESAS scored against **MODELA** - Species of Special Concern (n wndo. cont.):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELA**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
16 ESA XVI	1 Park	9	.03	20.45	.20	10.33
16 ESA XVI	10 Federal	35	.13	79.55	1.74	40.64
17 ESA XVII	0 null	1	.00	1.22	.01	.61
17 ESA XVII	1 Park	5	.02	6.10	.11	3.10
17 ESA XVII	10 Federal	76	.29	92.68	3.77	48.23

ESAS scored against **MODELA** - Species of Special Concern (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	439	30.76	2.43
19 ESA XIX	38	.56	18	1.26	.47

MODELA

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	5857	86.34	536732	90.02	91.64
1 Park	802	11.82	55809	9.36	69.59
5 State	125	1.84	3717	.62	29.74
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELA**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	38	.56	20.99	.65	10.82
18 ESA XVI	1 Park	69	1.02	38.12	8.60	23.36
18 ESA XVI	5 State	74	1.09	40.88	59.20	50.04
19 ESA XIX	0 null	20	.29	52.63	.34	26.49
19 ESA XIX	1 Park	18	.27	47.37	2.24	24.81

ESAS scored against **MODELB** - High Quality Areas (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	11868	23.86	.63
1 ESA I	509	1.96	670	1.35	1.32
2 ESA II	138	.53	875	1.76	6.34
3 ESA III	1034	3.98	9660	19.42	9.34
4 ESA IV	200	.77	0	.00	.00
5 ESA V	230	.88	1080	2.17	4.70
6 ESA VI	47	.18	25	.05	.53
7 ESA VII	77	.30	200	.40	2.60
8 ESA VIII	4121	15.85	23040	46.33	5.59
9 ESA IX	14	.05	26	.05	1.86
10 ESA X	36	.14	180	.36	5.00
11 ESA XI	95	.37	205	.41	2.16
12 ESA XII	49	.19	205	.41	4.18
13 ESA XIII	114	.44	602	1.21	5.28
14 ESA XIV	162	.62	158	.32	.98
15 ESA XV	86	.33	297	.60	3.45
16 ESA XVI	44	.17	230	.46	5.23
17 ESA XVII	82	.32	410	.82	5.00
MAP LAYER TOTAL	26000		49731		1.00

MODELB

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18143	69.78	6825	13.96	.38
1 Park	1351	5.20	11432	23.39	8.46
5 State	3336	12.83	12626	25.83	3.78
10 Federal	3170	12.19	18000	36.82	5.68
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELB**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	16811	64.66	88.66	92.66	90.66
0 null	1 Park	113	.43	.60	8.36	4.48
0 null	5 State	1725	6.63	9.10	51.71	30.40
0 null	10 Federal	313	1.20	1.65	9.87	5.76
1 ESA I	0 null	442	1.70	86.84	2.44	44.64
1 ESA I	10 Federal	67	.26	13.16	2.11	7.64
2 ESA II	0 null	32	.12	23.19	.18	11.68
2 ESA II	5 State	37	.14	26.81	1.11	13.96

ESAS scored against **MODELB** - High Quality Areas (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELB**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
2 ESA II	10 Federal	69	.27	50.00	2.18	26.09
3 ESA III	5 State	136	.52	13.15	4.08	8.61
3 ESA III	10 Federal	898	3.45	86.85	28.33	57.59
4 ESA IV	0 null	200	.77	100.00	1.10	50.55
5 ESA V	0 null	25	.10	10.87	.14	5.50
5 ESA V	5 State	194	.75	84.35	5.82	45.08
5 ESA V	10 Federal	11	.04	4.78	.35	2.56
6 ESA VI	0 null	42	.16	89.36	.23	44.80
6 ESA VI	5 State	5	.02	10.64	.15	5.39
7 ESA VII	0 null	57	.22	74.03	.31	37.17
7 ESA VII	10 Federal	20	.08	25.97	.63	13.30
8 ESA VIII	0 null	430	1.65	10.43	2.37	6.40
8 ESA VIII	1 Park	980	3.77	23.78	72.54	48.16
8 ESA VIII	5 State	1010	3.88	24.51	30.28	27.39
8 ESA VIII	10 Federal	1701	6.54	41.28	53.66	47.47
9 ESA IX	1 Park	11	.04	78.57	.81	39.69
9 ESA IX	5 State	3	.01	21.43	.09	10.76
10 ESA X	5 State	36	.14	100.00	1.08	50.54
11 ESA XI	0 null	54	.21	56.84	.30	28.57
11 ESA XI	5 State	41	.16	43.16	1.23	22.19
12 ESA XII	0 null	8	.03	16.33	.04	8.19
12 ESA XII	5 State	41	.16	83.67	1.23	42.45
13 ESA XIII	0 null	17	.07	14.91	.09	7.50
13 ESA XIII	1 Park	27	.10	23.68	2.00	12.84
13 ESA XIII	5 State	25	.10	21.93	.75	11.34
13 ESA XIII	10 Federal	45	.17	39.47	1.42	20.45
14 ESA XIV	0 null	4	.02	2.47	.02	1.25
14 ESA XIV	1 Park	158	.61	97.53	11.70	54.61
15 ESA XV	1 Park	62	.24	72.09	4.59	38.34
15 ESA XV	5 State	1	.00	1.16	.03	.60
15 ESA XV	10 Federal	23	.09	26.74	.73	13.73
16 ESA XVI	0 null	21	.08	47.73	.12	23.92
16 ESA XVI	10 Federal	23	.09	52.27	.73	26.50
17 ESA XVII	5 State	82	.32	100.00	2.46	51.23

ESAS scored against **MODELB** - High Quality Areas (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	1290	47.78	7.13
19 ESA XIX	38	.56	38	1.41	1.00

MODELB

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6094	89.83	580392	97.34	95.24
1 Park	325	4.79	821	.14	2.53
5 State	255	3.76	12417	2.08	48.69
10 Federal	110	1.62	2628	.44	23.89
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELB**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVII	0 null	25	.37	13.81	.41	7.11
18 ESA XVII	5 State	54	.80	29.83	21.18	25.51
18 ESA XVII	10 Federal	102	1.50	56.35	92.73	74.54
19 ESA XIX	1 Park	38	.56	100.00	11.69	55.85

ESAS scored against **MODELC** - High Diversity (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	2060	20.42	.11
1 ESA I	509	1.96	85	.84	.17
2 ESA II	138	.53	5	.05	.04
3 ESA III	1034	3.98	1665	16.50	1.61
4 ESA IV	200	.77	0	.00	.00
5 ESA V	230	.88	695	6.89	3.02
6 ESA VI	47	.18	105	1.04	2.23
7 ESA VII	77	.30	205	2.03	2.66
8 ESA VIII	4121	15.85	4235	41.97	1.03
9 ESA IX	14	.05	55	.55	3.93
10 ESA X	36	.14	0	.00	.00
11 ESA XI	95	.37	0	.00	.00
12 ESA XII	49	.19	75	.74	1.53
13 ESA XIII	114	.44	175	1.73	1.54
14 ESA XIV	162	.62	120	1.19	.74
15 ESA XV	86	.33	230	2.28	2.67
16 ESA XVI	44	.17	125	1.24	2.84
17 ESA XVII	82	.32	255	2.53	3.11
MAP LAYER TOTAL	26000		10090		.00

MODELC

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	23982	92.24	36954	75.60	1.54
5 State	2018	7.76	11929	24.40	5.91
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELC**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	18550	71.35	97.83	77.35	87.59
0 null	5 State	412	1.58	2.17	20.42	11.29
1 ESA I	0 null	492	1.89	96.66	2.05	49.36
1 ESA I	5 State	17	.07	3.34	.84	2.09
2 ESA II	0 null	137	.53	99.28	.57	49.92
2 ESA II	5 State	1	.00	.72	.05	.39
3 ESA III	0 null	701	2.70	67.79	2.92	35.36
3 ESA III	5 State	333	1.28	32.21	16.50	24.35

ESAS scored against **MODELC** - High Diversity (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELC**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
4 ESA IV	0 null	200	.77	100.00	.83	50.42
5 ESA V	0 null	91	.35	39.57	.38	19.97
5 ESA V	5 State	139	.53	60.43	6.89	33.66
6 ESA VI	0 null	26	.10	55.32	.11	27.71
6 ESA VI	5 State	21	.08	44.68	1.04	22.86
7 ESA VII	0 null	36	.14	46.75	.15	23.45
7 ESA VII	5 State	41	.16	53.25	2.03	27.64
8 ESA VIII	0 null	3274	12.59	79.45	13.65	46.55
8 ESA VIII	5 State	847	3.26	20.55	41.97	31.26
9 ESA IX	0 null	3	.01	21.43	.01	10.72
9 ESA IX	5 State	11	.04	78.57	.55	39.56
10 ESA X	0 null	36	.14	100.00	.15	50.08
11 ESA XI	0 null	95	.37	100.00	.40	50.20
12 ESA XII	0 null	34	.13	69.39	.14	34.76
12 ESA XII	5 State	15	.06	30.61	.74	15.68
13 ESA XIII	0 null	79	.30	69.30	.33	34.81
13 ESA XIII	5 State	35	.13	30.70	1.73	16.22
14 ESA XIV	0 null	138	.53	85.19	.58	42.88
14 ESA XIV	5 State	24	.09	14.81	1.19	8.00
15 ESA XV	0 null	40	.15	46.51	.17	23.34
15 ESA XV	5 State	46	.18	53.49	2.28	27.88
16 ESA XVI	0 null	19	.07	43.18	.08	21.63
16 ESA XVI	5 State	25	.10	56.82	1.24	29.03
17 ESA XVII	0 null	31	.12	37.80	.13	18.97
17 ESA XVII	5 State	51	.20	62.20	2.53	32.36

ESAS scored against **MODELC** - High Diversity (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	65	15.12	.36
19 ESA XIX	38	.56	40	9.30	1.05

MODELC

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6698	98.73	595038	99.80	88.84
5 state	86	1.27	1220	.20	14.19
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELC**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	168	2.48	92.82	2.51	47.66
18 ESA XVI	5 State	13	.19	7.18	15.12	11.15
19 ESA XIX	0 null	30	.44	78.95	.45	39.70
19 ESA XIX	5 State	8	.12	21.05	9.30	15.18

ESAS scored against **MODELD** - Ecological Function (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	1960	7.43	.10
1 ESA I	509	1.96	235	.89	.46
2 ESA II	138	.53	250	.95	1.81
3 ESA III	1034	3.98	3970	15.04	3.84
4 ESA IV	200	.77	1000	3.79	5.00
5 ESA V	230	.88	950	3.60	4.13
6 ESA VI	47	.18	0	.00	.00
7 ESA VII	77	.30	275	1.04	3.57
8 ESA VIII	4121	15.85	17225	65.27	4.18
9 ESA IX	14	.05	0	.00	.00
10 ESA X	36	.14	0	.00	.00
11 ESA XI	95	.37	0	.00	.00
12 ESA XII	49	.19	0	.00	.00
13 ESA XIII	114	.44	35	.13	.31
14 ESA XIV	162	.62	0	.00	.00
15 ESA XV	86	.33	0	.00	.00
16 ESA XVI	44	.17	175	.66	3.98
17 ESA XVII	82	.32	315	1.19	3.84
MAP LAYER TOTAL	26000		26390		1.00

MODELD

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	21498	82.68	21105	43.17	.98
5 one func.	3726	14.33	21610	44.21	5.80
10 two func.	776	2.98	6168	12.62	7.95
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELD**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	18575	71.44	97.96	86.40	92.18
0 null	5 one fun	382	1.47	2.01	10.25	6.13
0 null	10 two fun	5	.02	.03	.64	.34
1 ESA I	0 null	462	1.78	90.77	2.15	46.46
1 ESA I	5 one fun	47	.18	9.23	1.26	5.25
2 ESA II	0 null	88	.34	63.77	.41	32.09
2 ESA II	5 one fun	50	.19	36.23	1.34	18.79

ESAS scored against **MODELD** - Ecological Function (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELD**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
3 ESA III	0 null	240	.92	23.21	1.12	12.16
3 ESA III	5 one fun	794	3.05	76.79	21.31	49.05
4 ESA IV	5 one fun	200	.77	100.00	5.37	52.68
5 ESA V	0 null	40	.15	17.39	.19	8.79
5 ESA V	5 one fun	190	.73	82.61	5.10	43.85
6 ESA VI	0 null	47	.18	100.00	.22	50.11
7 ESA VII	0 null	22	.08	28.57	.10	14.34
7 ESA VII	5 one fun	55	.21	71.43	1.48	36.45
8 ESA VIII	0 null	1447	5.57	35.11	6.73	20.92
8 ESA VIII	5 one fun	1903	7.32	46.18	51.07	48.63
8 ESA VIII	10 two fun	771	2.97	18.71	99.36	59.03
9 ESA IX	0 null	14	.05	100.00	.07	50.03
10 ESA X	0 null	36	.14	100.00	.17	50.08
11 ESA XI	0 null	95	.37	100.00	.44	50.22
12 ESA XII	0 null	49	.19	100.00	.23	50.11
13 ESA XIII	0 null	107	.41	93.86	.50	47.18
13 ESA XIII	5 one fun	7	.03	6.14	.19	3.16
14 ESA XIV	0 null	162	.62	100.00	.75	50.38
15 ESA XV	0 null	86	.33	100.00	.40	50.20
16 ESA XVI	0 null	9	.03	20.45	.04	10.25
16 ESA XVI	5 one fun	35	.13	79.55	.94	40.24
17 ESA XVII	0 null	19	.07	23.17	.09	11.63
17 ESA XVII	5 one fun	63	.24	76.83	1.69	39.26

ESAS scored against **MODELD** - Ecological Function (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	470	100.00	2.60
19 ESA XIX	38	.56	0	.00	.00

MODELD

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6690	98.61	594566	99.72	88.87
5 one func.	94	1.39	1692	.28	18.00
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES	MAP LAYER #2 CATEGORIES	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	87	1.28	48.07	1.30	24.68
18 ESA XVI	5 one func.	94	1.39	51.93	100.00	75.97
19 ESA XIX	0 null	38	.56	100.00	.57	50.28

ESAS scored against **MODELE** - Large Areas (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	6370	9.54	.34
1 ESA I	509	1.96	2160	3.24	4.24
2 ESA II	138	.53	550	.82	3.99
3 ESA III	1034	3.98	9180	13.75	8.88
4 ESA IV	200	.77	0	.00	.00
5 ESA V	230	.88	1990	2.98	8.65
6 ESA VI	47	.18	0	.00	.00
7 ESA VII	77	.30	770	1.15	10.00
8 ESA VIII	4121	15.85	40900	61.27	9.92
9 ESA IX	14	.05	0	.00	.00
10 ESA X	36	.14	0	.00	.00
11 ESA XI	95	.37	0	.00	.00
12 ESA XII	49	.19	470	.70	9.59
13 ESA XIII	114	.44	1100	1.65	9.65
14 ESA XIV	162	.62	1620	2.43	10.00
15 ESA XV	86	.33	850	1.27	9.88
16 ESA XVI	44	.17	0	.00	.00
17 ESA XVII	82	.32	790	1.18	9.63
MAP LAYER TOTAL	26000		66750		2.00

MODELE

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	19325	74.33	4669	9.55	.24
10 Federal	6675	25.67	44214	90.45	6.62
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELE**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	18325	70.48	96.64	94.83	95.73
0 null	10 Federal	637	2.45	3.36	9.54	6.45
1 ESA I	0 null	293	1.13	57.56	1.52	29.54
1 ESA I	10 Federal	216	.83	42.44	3.24	22.84
2 ESA II	0 null	83	.32	60.14	.43	30.29
2 ESA II	10 Federal	55	.21	39.86	.82	20.34
3 ESA III	0 null	116	.45	11.22	.60	5.91
3 ESA III	10 Federal	918	3.53	88.78	13.75	51.27

ESAS scored against **MODELE** - Large Areas (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELE**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
4 ESA IV	0 null	200	.77	100.00	1.03	50.52
5 ESA V	0 null	31	.12	13.48	.16	6.82
5 ESA V	10 Federal	199	.77	86.52	2.98	44.75
6 ESA VI	0 null	47	.18	100.00	.24	50.12
7 ESA VII	10 Federal	77	.30	100.00	1.15	50.58
8 ESA VIII	0 null	31	.12	.75	.16	.46
8 ESA VIII	10 Federal	4090	15.73	99.25	61.27	80.26
9 ESA IX	0 null	14	.05	100.00	.07	50.04
10 ESA X	0 null	36	.14	100.00	.19	50.09
11 ESA XI	0 null	95	.37	100.00	.49	50.25
12 ESA XII	0 null	2	.01	4.08	.01	2.05
12 ESA XII	10 Federal	47	.18	95.92	.70	48.31
13 ESA XIII	0 null	4	.02	3.51	.02	1.76
13 ESA XIII	10 Federal	110	.42	96.49	1.65	49.07
14 ESA XIV	10 Federal	162	.62	100.00	2.43	51.21
15 ESA XV	0 null	1	.00	1.16	.01	.58
15 ESA XV	10 Federal	85	.33	98.84	1.27	50.06
16 ESA XVI	0 null	44	.17	100.00	.23	50.11
17 ESA XVII	0 null	3	.01	3.66	.02	1.84
17 ESA XVII	10 Federal	79	.30	96.34	1.18	48.76

ESAS scored against **MODELE** - Large Areas (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	870	100.00	4.81
19 ESA XIX	38	.56	0	.00	.00

MODELE

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6697	98.72	594692	99.74	88.80
10 Federal	87	1.28	1566	.26	18.00
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES	MAP LAYER #2 CATEGORIES	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	94	1.39	51.93	1.40	26.67
18 ESA XVI	10 Federal	87	1.28	48.07	100.00	74.03
19 ESA XIX	0 null	38	.56	100.00	.57	50.28

ESAS scored against **MODELF** - Landform (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	3105	31.47	.16
1 ESA I	509	1.96	870	8.82	1.71
2 ESA II	138	.53	30	.30	.22
3 ESA III	1034	3.98	2945	29.85	2.85
4 ESA IV	200	.77	0	.00	.00
5 ESA V	230	.88	145	1.47	.63
6 ESA VI	47	.18	140	1.42	2.98
7 ESA VII	77	.30	165	1.67	2.14
8 ESA VIII	4121	15.85	2450	24.84	.59
9 ESA IX	14	.05	15	.15	1.07
10 ESA X	36	.14	0	.00	.00
11 ESA XI	95	.37	0	.00	.00
12 ESA XII	49	.19	0	.00	.00
13 ESA XIII	114	.44	0	.00	.00
14 ESA XIV	162	.62	0	.00	.00
15 ESA XV	86	.33	0	.00	.00
16 ESA XVI	44	.17	0	.00	.00
17 ESA XVII	82	.32	0	.00	.00
MAP LAYER TOTAL	26000		9865		.00

MODELF

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	24027	92.41	42439	86.82	1.77
5 State	1973	7.59	6444	13.18	3.27
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELF**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	18341	70.54	96.73	76.33	86.53
0 null	5 State	621	2.39	3.27	31.47	17.37
1 ESA I	0 null	335	1.29	65.82	1.39	33.60
1 ESA I	5 State	174	.67	34.18	8.82	21.50
2 ESA II	0 null	132	.51	95.65	.55	48.10
2 ESA II	5 State	6	.02	4.35	.30	2.33
3 ESA III	0 null	445	1.71	43.04	1.85	22.44
3 ESA III	5 State	589	2.27	56.96	29.85	43.41

ESAS scored against **MODELF** - Landform (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELF**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
4 ESA IV	0 null	200	.77	100.00	.83	50.42
5 ESA V	0 null	201	.77	87.39	.84	44.11
5 ESA V	5 State	29	.11	12.61	1.47	7.04
6 ESA VI	0 null	19	.07	40.43	.08	20.25
6 ESA VI	5 State	28	.11	59.57	1.42	30.50
7 ESA VII	0 null	44	.17	57.14	.18	28.66
7 ESA VII	5 State	33	.13	42.86	1.67	22.26
8 ESA VIII	0 null	3631	13.97	88.11	15.11	51.61
8 ESA VIII	5 State	490	1.88	11.89	24.84	18.36
9 ESA IX	0 null	11	.04	78.57	.05	39.31
9 ESA IX	5 State	3	.01	21.43	.15	10.79
10 ESA X	0 null	36	.14	100.00	.15	50.07
11 ESA XI	0 null	95	.37	100.00	.40	50.20
12 ESA XII	0 null	49	.19	100.00	.20	50.10
13 ESA XIII	0 null	114	.44	100.00	.47	50.24
14 ESA XIV	0 null	162	.62	100.00	.67	50.34
15 ESA XV	0 null	86	.33	100.00	.36	50.18
16 ESA XVI	0 null	44	.17	100.00	.18	50.09
17 ESA XVII	0 null	82	.32	100.00	.34	50.17

ESAS scored against **MODELF** - Landform (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	0	.00	.00
19 ESA XIX	38	.56	30	4.84	.79

MODELF

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6660	98.17	585980	98.28	87.98
5 State	124	1.83	10278	1.72	82.89
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES	MAP LAYER #2 CATEGORIES	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	181	2.67	100.00	2.72	51.36
19 ESA XIX	0 null	32	.47	84.21	.48	42.35
19 ESA XIX	5 State	6	.09	15.79	4.84	10.31

ESAS scored against **MODELG** - Scientific Research (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	827	16.28	.04
1 ESA I	509	1.96	0	.00	.00
2 ESA II	138	.53	0	.00	.00
3 ESA III	1034	3.98	1224	24.09	1.18
4 ESA IV	200	.77	0	.00	.00
5 ESA V	230	.88	0	.00	.00
6 ESA VI	47	.18	0	.00	.00
7 ESA VII	77	.30	130	2.56	1.69
8 ESA VIII	4121	15.85	2010	39.57	.49
9 ESA IX	14	.05	14	.28	1.00
10 ESA X	36	.14	0	.00	.00
11 ESA XI	95	.37	0	.00	.00
12 ESA XII	49	.19	0	.00	.00
13 ESA XIII	114	.44	33	.65	.29
14 ESA XIV	162	.62	122	2.40	.75
15 ESA XV	86	.33	60	1.18	.70
16 ESA XVI	44	.17	35	.69	.80
17 ESA XVII	82	.32	625	12.30	7.62
MAP LAYER TOTAL	26000		5080		.00

MODELG

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	23702	91.16	33953	69.46	1.43
1 Park	1935	7.44	12330	25.22	6.37
5 State	97	.37	664	1.36	6.85
10 Federal	266	1.02	1936	3.96	7.28
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELG**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0 null	18360	70.62	96.83	77.46	87.14
0 null	1 Park	572	2.20	3.02	29.56	16.29
0 null	5 State	9	.03	.05	9.28	4.66
0 null	10 Federal	21	.08	.11	7.89	4.00
1 ESA I	0 null	509	1.96	100.00	2.15	51.07
2 ESA II	0 null	138	.53	100.00	.58	50.29
3 ESA III	0 null	850	3.27	82.21	3.59	42.90

ESAS scored against **MODELG** - Scientific Research (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MODELG**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
3 ESA III	1 Park	64	.25	6.19	3.31	4.75
3 ESA III	5 State	8	.03	.77	8.25	4.51
3 ESA III	10 Federal	112	.43	10.83	42.11	26.47
4 ESA IV	0 null	200	.77	100.00	.84	50.42
5 ESA V	0 null	230	.88	100.00	.97	50.49
6 ESA VI	0 null	47	.18	100.00	.20	50.10
7 ESA VII	0 null	64	.25	83.12	.27	41.69
7 ESA VII	10 Federal	13	.05	16.88	4.89	10.89
8 ESA VIII	0 null	2962	11.39	71.88	12.50	42.19
8 ESA VIII	1 Park	1020	3.92	24.75	52.71	38.73
8 ESA VIII	5 State	80	.31	1.94	82.47	42.21
8 ESA VIII	10 Federal	59	.23	1.43	22.18	11.81
9 ESA IX	1 Park	14	.05	100.00	.72	50.36
10 ESA X	0 null	36	.14	100.00	.15	50.08
11 ESA XI	0 null	95	.37	100.00	.40	50.20
12 ESA XII	0 null	49	.19	100.00	.21	50.10
13 ESA XIII	0 null	81	.31	71.05	.34	35.70
13 ESA XIII	1 Park	33	.13	28.95	1.71	15.33
14 ESA XIV	0 null	40	.15	24.69	.17	12.43
14 ESA XIV	1 Park	122	.47	75.31	6.30	40.81
15 ESA XV	0 null	26	.10	30.23	.11	15.17
15 ESA XV	1 Park	60	.23	69.77	3.10	36.43
16 ESA XVI	0 null	9	.03	20.45	.04	10.25
16 ESA XVI	1 Park	35	.13	79.55	1.81	40.68
17 ESA XVII	0 null	6	.02	7.32	.03	3.67
17 ESA XVII	1 Park	15	.06	18.29	.78	9.53
17 ESA XVII	10 Federal	61	.23	74.39	22.93	48.66

ESAS scored against **MODELG** - Scientific Research (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	0	.00	.00
19 ESA XIX	38	.56	380	100.00	10.00

MODELG

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	6746	99.44	595536	99.88	88.28
10 Federal	38	.56	722	.12	19.00
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES	MAP LAYER #2 CATEGORIES	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVI	0 null	181	2.67	100.00	2.68	51.34
19 ESA XIX	10 Federal	38	.56	100.00	100.00	100.00

ESAS scored against **MCOMP** - Composite Model (north window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0 null	18962	72.93	32069	15.76	1.69
1 ESA I	509	1.96	9110	4.48	17.90
2 ESA II	138	.53	3090	1.52	22.39
3 ESA III	1034	3.98	31896	15.68	30.85
4 ESA IV	200	.77	2000	.98	10.00
5 ESA V	230	.88	5235	2.57	22.76
6 ESA VI	47	.18	364	.18	7.74
7 ESA VII	77	.30	1920	.94	24.94
8 ESA VIII	4121	15.85	105617	51.91	25.63
9 ESA IX	14	.05	155	.08	11.07
10 ESA X	36	.14	360	.18	10.00
11 ESA XI	95	.37	680	.33	7.16
12 ESA XII	49	.19	901	.44	18.39
13 ESA XIII	114	.44	2155	1.06	18.90
14 ESA XIV	162	.62	2192	1.08	13.53
15 ESA XV	86	.33	1619	.80	18.83
16 ESA XVI	44	.17	924	.45	21.00
17 ESA XVII	82	.32	3160	1.55	38.54
MAP LAYER TOTAL	26000		203447		7.00

MCOMP

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0	15326	58.95	34	.07	.00
1	433	1.67	20	.04	.05
2	22	.08	9	.02	.41
3	1	.00	0	.00	.00
5	803	3.09	652	1.33	.81
6	1181	4.54	277	.57	.23
7	25	.10	0	.00	.00
8	15	.06	36	.07	2.40
10	939	3.61	2407	4.92	2.56
11	344	1.32	1506	3.08	4.38
12	244	.94	2054	4.20	8.42
13	72	.28	825	1.69	11.46
15	489	1.88	1841	3.77	3.76
16	434	1.67	2548	5.21	5.87
17	116	.45	906	1.85	7.81
18	88	.34	994	2.03	11.30
20	397	1.53	1283	2.62	3.23
21	600	2.31	4541	9.29	7.57
22	377	1.45	3107	6.36	8.24
23	4	.02	32	.07	8.00
25	324	1.25	1556	3.18	4.80
26	963	3.70	6381	13.05	6.63

ESAS scored against **MCOMP** - Composite Model (north window continued):

27	242	.93	1791	3.66	7.40
30	545	2.10	3125	6.39	5.73
31	656	2.52	4507	9.22	6.87
32	110	.42	689	1.41	6.26
35	441	1.70	2705	5.53	6.13
36	302	1.16	1819	3.72	6.02
37	16	.06	75	.15	4.69
40	215	.83	1103	2.26	5.13
41	87	.33	576	1.18	6.62
45	96	.37	1090	2.23	11.35
46	41	.16	188	.38	4.59
50	46	.18	173	.35	3.76
51	2	.01	16	.03	8.00
55	4	.02	17	.03	4.25
MAP LAYER TOTAL	26000		48883		1.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
0 null	0	15320	58.92	80.79	99.96	90.38
0 null	1	429	1.65	2.26	99.08	50.67
0 null	2	21	.08	.11	95.45	47.78
0 null	3	1	.00	.01	100.00	50.00
0 null	5	736	2.83	3.88	91.66	47.77
0 null	6	1144	4.40	6.03	96.87	51.45
0 null	7	25	.10	.13	100.00	50.07
0 null	8	11	.04	.06	73.33	36.70
0 null	10	397	1.53	2.09	42.28	22.19
0 null	11	178	.68	.94	51.74	26.34
0 null	12	42	.16	.22	17.21	8.72
0 null	13	9	.03	.05	12.50	6.27
0 null	15	70	.27	.37	14.31	7.34
0 null	16	141	.54	.74	32.49	16.62
0 null	17	22	.08	.12	18.97	9.54
0 null	20	91	.35	.48	22.92	11.70
0 null	21	37	.14	.20	6.17	3.18
0 null	22	4	.02	.02	1.06	.54
0 null	25	71	.27	.37	21.91	11.14
0 null	26	110	.42	.58	11.42	6.00
0 null	27	17	.07	.09	7.02	3.56
0 null	30	22	.08	.12	4.04	2.08
0 null	31	29	.11	.15	4.42	2.29
0 null	32	12	.05	.06	10.91	5.49
0 null	35	6	.02	.03	1.36	.70
0 null	36	15	.06	.08	4.97	2.52
0 null	37	1	.00	.01	6.25	3.13
0 null	50	1	.00	.01	2.17	1.09
1 ESA I	10	117	.45	22.99	12.46	17.72

ESAS scored against **MCOMP** - Composite Model (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
1 ESA I	15	175	.67	34.38	35.79	35.08
1 ESA I	20	121	.47	23.77	30.48	27.13
1 ESA I	25	27	.10	5.30	8.33	6.82
1 ESA I	30	44	.17	8.64	8.07	8.36
1 ESA I	35	20	.08	3.93	4.54	4.23
1 ESA I	40	5	.02	.98	2.33	1.65
2 ESA II	10	32	.12	23.19	3.41	13.30
2 ESA II	15	23	.09	16.67	4.70	10.69
2 ESA II	20	26	.10	18.84	6.55	12.69
2 ESA II	25	3	.01	2.17	.93	1.55
2 ESA II	30	13	.05	9.42	2.39	5.90
2 ESA II	35	40	.15	28.99	9.07	19.03
2 ESA II	40	1	.00	.72	.47	.59
3 ESA III	5	7	.03	.68	.87	.77
3 ESA III	10	62	.24	6.00	6.60	6.30
3 ESA III	11	7	.03	.68	2.03	1.36
3 ESA III	15	41	.16	3.97	8.38	6.17
3 ESA III	16	3	.01	.29	.69	.49
3 ESA III	20	28	.11	2.71	7.05	4.88
3 ESA III	21	39	.15	3.77	6.50	5.14
3 ESA III	25	55	.21	5.32	16.98	11.15
3 ESA III	26	81	.31	7.83	8.41	8.12
3 ESA III	27	7	.03	.68	2.89	1.78
3 ESA III	30	118	.45	11.41	21.65	16.53
3 ESA III	31	133	.51	12.86	20.27	16.57
3 ESA III	32	19	.07	1.84	17.27	9.56
3 ESA III	35	88	.34	8.51	19.95	14.23
3 ESA III	36	96	.37	9.28	31.79	20.54
3 ESA III	37	9	.03	.87	56.25	28.56
3 ESA III	40	136	.52	13.15	63.26	38.20
3 ESA III	41	24	.09	2.32	27.59	14.95
3 ESA III	45	13	.05	1.26	13.54	7.40
3 ESA III	46	28	.11	2.71	68.29	35.50
3 ESA III	50	37	.14	3.58	80.43	42.01
3 ESA III	55	3	.01	.29	75.00	37.65
4 ESA IV	10	200	.77	100.00	21.30	60.65
5 ESA V	0	2	.01	.87	.01	.44
5 ESA V	1	4	.02	1.74	.92	1.33
5 ESA V	5	1	.00	.43	.12	.28
5 ESA V	6	13	.05	5.65	1.10	3.38
5 ESA V	10	1	.00	.43	.11	.27
5 ESA V	11	6	.02	2.61	1.74	2.18
5 ESA V	15	8	.03	3.48	1.64	2.56
5 ESA V	20	27	.10	11.74	6.80	9.27

ESAS scored against **MCOMP** - Composite Model (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
5 ESA V	21	24	.09	10.43	4.00	7.22
5 ESA V	25	10	.04	4.35	3.09	3.72
5 ESA V	26	95	.37	41.30	9.87	25.58
5 ESA V	30	30	.12	13.04	5.50	9.27
5 ESA V	31	7	.03	3.04	1.07	2.06
5 ESA V	35	1	.00	.43	.23	.33
5 ESA V	36	1	.00	.43	.33	.38
6 ESA VI	0	4	.02	8.51	.03	4.27
6 ESA VI	5	4	.02	8.51	.50	4.50
6 ESA VI	6	16	.06	34.04	1.35	17.70
6 ESA VI	10	9	.03	19.15	.96	10.05
6 ESA VI	11	13	.05	27.66	3.78	15.72
6 ESA VI	15	1	.00	2.13	.20	1.17
7 ESA VII	10	2	.01	2.60	.21	1.41
7 ESA VII	15	2	.01	2.60	.41	1.50
7 ESA VII	16	12	.05	15.58	2.76	9.17
7 ESA VII	20	8	.03	10.39	2.02	6.20
7 ESA VII	21	15	.06	19.48	2.50	10.99
7 ESA VII	25	6	.02	7.79	1.85	4.82
7 ESA VII	26	9	.03	11.69	.93	6.31
7 ESA VII	30	7	.03	9.09	1.28	5.19
7 ESA VII	31	1	.00	1.30	.15	.73
7 ESA VII	35	6	.02	7.79	1.36	4.58
7 ESA VII	36	3	.01	3.90	.99	2.44
7 ESA VII	40	4	.02	5.19	1.86	3.53
7 ESA VII	50	2	.01	2.60	4.35	3.47
8 ESA VIII	5	1	.00	.02	.12	.07
8 ESA VIII	10	38	.15	.92	4.05	2.48
8 ESA VIII	11	96	.37	2.33	27.91	15.12
8 ESA VIII	12	124	.48	3.01	50.82	26.91
8 ESA VIII	13	11	.04	.27	15.28	7.77
8 ESA VIII	15	150	.58	3.64	30.67	17.16
8 ESA VIII	16	239	.92	5.80	55.07	30.43
8 ESA VIII	17	69	.27	1.67	59.48	30.58
8 ESA VIII	18	41	.16	.99	46.59	23.79
8 ESA VIII	20	80	.31	1.94	20.15	11.05
8 ESA VIII	21	432	1.66	10.48	72.00	41.24
8 ESA VIII	22	354	1.36	8.59	93.90	51.24
8 ESA VIII	23	4	.02	.10	100.00	50.05
8 ESA VIII	25	141	.54	3.42	43.52	23.47
8 ESA VIII	26	628	2.42	15.24	65.21	40.23
8 ESA VIII	27	214	.82	5.19	88.43	46.81
8 ESA VIII	30	309	1.19	7.50	56.70	32.10
8 ESA VIII	31	463	1.78	11.24	70.58	40.91
8 ESA VIII	32	79	.30	1.92	71.82	36.87

ESAS scored against **MCOMP** - Composite Model (north window continued):

MAP LAYER #1 CATEGORIES ESAS	MAP LAYER #2 CATEGORIES MCOMP	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
8 ESA VIII	35	274	1.05	6.65	62.13	34.39
8 ESA VIII	36	186	.72	4.51	61.59	33.05
8 ESA VIII	37	6	.02	.15	37.50	18.82
8 ESA VIII	40	57	.22	1.38	26.51	13.95
8 ESA VIII	41	63	.24	1.53	72.41	36.97
8 ESA VIII	45	40	.15	.97	41.67	21.32
8 ESA VIII	46	13	.05	.32	31.71	16.01
8 ESA VIII	50	6	.02	.15	13.04	6.59
8 ESA VIII	51	2	.01	.05	100.00	50.02
8 ESA VIII	55	1	.00	.02	25.00	12.51
9 ESA IX	2	1	.00	7.14	4.55	5.84
9 ESA IX	8	4	.02	28.57	26.67	27.62
9 ESA IX	12	6	.02	42.86	2.46	22.66
9 ESA IX	16	2	.01	14.29	.46	7.37
9 ESA IX	17	1	.00	7.14	.86	4.00
10 ESA X	10	36	.14	100.00	3.83	51.92
11 ESA XI	5	54	.21	56.84	6.72	31.78
11 ESA XI	10	41	.16	43.16	4.37	23.76
12 ESA XII	11	4	.02	8.16	1.16	4.66
12 ESA XII	15	16	.06	32.65	3.27	17.96
12 ESA XII	16	3	.01	6.12	.69	3.41
12 ESA XII	20	13	.05	26.53	3.27	14.90
12 ESA XII	21	4	.02	8.16	.67	4.41
12 ESA XII	25	9	.03	18.37	2.78	10.57
13 ESA XIII	6	4	.02	3.51	.34	1.92
13 ESA XIII	10	4	.02	3.51	.43	1.97
13 ESA XIII	11	10	.04	8.77	2.91	5.84
13 ESA XIII	12	5	.02	4.39	2.05	3.22
13 ESA XIII	13	6	.02	5.26	8.33	6.80
13 ESA XIII	15	1	.00	.88	.20	.54
13 ESA XIII	16	11	.04	9.65	2.53	6.09
13 ESA XIII	17	3	.01	2.63	2.59	2.61
13 ESA XIII	18	10	.04	8.77	11.36	10.07
13 ESA XIII	20	3	.01	2.63	.76	1.69
13 ESA XIII	21	27	.10	23.68	4.50	14.09
13 ESA XIII	22	3	.01	2.63	.80	1.71
13 ESA XIII	26	21	.08	18.42	2.18	10.30
13 ESA XIII	27	1	.00	.88	.41	.65
13 ESA XIII	31	5	.02	4.39	.76	2.57
14 ESA XIV	11	26	.10	16.05	7.56	11.80
14 ESA XIV	12	62	.24	38.27	25.41	31.84
14 ESA XIV	13	31	.12	19.14	43.06	31.10

ESAS scored against **MCOMP** - Composite Model (north window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
14 ESA XIV	16	11	.04	6.79	2.53	4.66
14 ESA XIV	17	9	.03	5.56	7.76	6.66
14 ESA XIV	18	19	.07	11.73	21.59	16.66
14 ESA XIV	22	4	.02	2.47	1.06	1.77
15 ESA XV	12	5	.02	5.81	2.05	3.93
15 ESA XV	13	15	.06	17.44	20.83	19.14
15 ESA XV	15	1	.00	1.16	.20	.68
15 ESA XV	17	12	.05	13.95	10.34	12.15
15 ESA XV	18	18	.07	20.93	20.45	20.69
15 ESA XV	21	10	.04	11.63	1.67	6.65
15 ESA XV	22	12	.05	13.95	3.18	8.57
15 ESA XV	25	2	.01	2.33	.62	1.47
15 ESA XV	26	6	.02	6.98	.62	3.80
15 ESA XV	27	3	.01	3.49	1.24	2.36
15 ESA XV	30	2	.01	2.33	.37	1.35
16 ESA XVI	6	4	.02	9.09	.34	4.71
16 ESA XVI	11	1	.00	2.27	.29	1.28
16 ESA XVI	16	12	.05	27.27	2.76	15.02
16 ESA XVI	21	10	.04	22.73	1.67	12.20
16 ESA XVI	26	8	.03	18.18	.83	9.51
16 ESA XVI	31	9	.03	20.45	1.37	10.91
17 ESA XVII	11	3	.01	3.66	.87	2.27
17 ESA XVII	15	1	.00	1.22	.20	.71
17 ESA XVII	21	2	.01	2.44	.33	1.39
17 ESA XVII	26	5	.02	6.10	.52	3.31
17 ESA XVII	31	9	.03	10.98	1.37	6.17
17 ESA XVII	35	6	.02	7.32	1.36	4.34
17 ESA XVII	36	1	.00	1.22	.33	.78
17 ESA XVII	40	12	.05	14.63	5.58	10.11
17 ESA XVII	45	43	.17	52.44	44.79	48.62

ESAS scored against **MCOMP** - Composite Model (south window):

ESAS

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
18 ESA XVIII	181	2.67	3134	45.44	17.31
19 ESA XIX	38	.56	506	7.34	13.32

MCOMP

CATEGORIES	# OF CELLS	% OF TTL AREA	SCORE	% OF TTL SCORE	AVG SCORE
0	5538	81.63	534501	89.64	96.52
1	565	8.33	33480	5.62	59.26
2	62	.91	0	.00	.00
5	123	1.81	2985	.50	24.27
6	286	4.22	20916	3.51	73.13
7	31	.46	0	.00	.00
10	19	.28	819	.14	43.11
11	37	.55	1242	.21	33.57
12	8	.12	152	.03	19.00
15	4	.06	153	.03	38.25
16	10	.15	182	.03	18.20
17	8	.12	152	.03	19.00
20	10	.15	180	.03	18.00
22	2	.03	38	.01	19.00
25	15	.22	270	.05	18.00
26	6	.09	108	.02	18.00
30	52	.77	936	.16	18.00
31	1	.01	18	.00	18.00
35	7	.10	126	.02	18.00
MAP LAYER TOTAL	6784		596258		87.00

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVIII	0	10	.15	5.52	.18	2.85
18 ESA XVIII	1	14	.21	7.73	2.48	5.11
18 ESA XVIII	5	8	.12	4.42	6.50	5.46
18 ESA XVIII	6	34	.50	18.78	11.89	15.34
18 ESA XVIII	10	7	.10	3.87	36.84	20.35
18 ESA XVIII	11	6	.09	3.31	16.22	9.77
18 ESA XVIII	15	3	.04	1.66	75.00	38.33
18 ESA XVIII	16	8	.12	4.42	80.00	42.21
18 ESA XVIII	20	10	.15	5.52	100.00	52.76
18 ESA XVIII	25	15	.22	8.29	100.00	54.14
18 ESA XVIII	26	6	.09	3.31	100.00	51.66
18 ESA XVIII	30	52	.77	28.73	100.00	64.36

ESAS scored against **MCOMP** - Composite Model (south window continued):

MAP LAYER #1 CATEGORIES **ESAS**	MAP LAYER #2 CATEGORIES **MCOMP**	# OF POINTS	% OF TTL AREA	MAP #1 AREA	MAP #2 AREA	% IN OVERLAP
18 ESA XVIII	31	1	.01	.55	100.00	50.28
18 ESA XVIII	35	7	.10	3.87	100.00	51.93
19 ESA XIX	11	18	.27	47.37	48.65	48.01
19 ESA XIX	12	8	.12	21.05	100.00	60.53
19 ESA XIX	16	2	.03	5.26	20.00	12.63
19 ESA XIX	17	8	.12	21.05	100.00	60.53
19 ESA XIX	22	2	.03	5.26	100.00	52.63

APPENDIX G

ESA

ESAs ON TOPO BASE MAP

SCALE: 1" = 800'